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INTRODUCTION

Purpose

Forest resource managers are responsible for developing management strategies based on landowner objectives to guide the production of forest goods and services. Recent developments in the land management planning process on public lands have placed emphasis on: 1) characterizing a landscapes' potential productivity for various outputs and associated costs; 2) defining operational landowner objectives; and 3) integrating wildlife habitat and forest management opportunities and implementation strategies to efficiently achieve a common set of goals.

This workshop will provide information on patterns of wildlife species' distribution, their habitat relationships with forest types and size age classes and nonforest habitats as well as each species' vegetative and non-vegetative structural habitat needs. Ranges of wildlife habitat potentials are discussed for 2 northern hardwoods and hemlock forest cover types, given: 1) ecological site conditions upon which they occur; 2) the management systems (i.e. all-aged/even-aged and minimum/no vegetative management) used to either maintain or convert an existing forest type; and 3) cultural practices and associated management activities (i.e. site preparation, release, tending, thinning, harvesting, road development and access (for human use) needed to accomplish any objective).

Comparisons of wildlife habitat potentials, opportunities and costs among differing ecological site conditions, types of management systems, various cultural practice and associated activities will be presented; ranges of alternatives can then be considered and courses of action selected which best meet the objectives of the forest.

Patterns of wildlife species' habitat use have been categorized by components that are: 1) recognizable on the ground to resource managers and specialists; 2) capable of being manipulated through various silvicultural systems, cultural practices and associated activities which result in accomplishing forest objectives; and 3) presented in a manner so that the overwhelming amount of wildlife habitat information is easier to use and understandable to various types of resource professional. Public land managers and resource specialists will hopefully find this workshop helpful in 1) exploring effective and efficient ecological methods of coordinating wildlife habitat/vegetative management (timber) opportunities and implementation strategies; and 2) more accurately assessing management alternatives and outputs in the future.

Historical Perspective

New England's woodlands provide an array of habitats that support a wide range of wildlife communities. Now mostly forested, the New England landscape has changed dramatically over the last 350 years. Once covered by the primeval forest, land was cleared for agriculture -- slowly until the mid-18th century -- then at an increased pace until, between 1820 and 1840, 75 percent of the arable land in southern and central New England was in farm crops and pasturage. One hundred years later New England was again mostly forested -- the result of an era of farm abandonment that began in 1830 with the opening of rich farmlands of Ohio via the Erie canal.

From 1880 to the 1920's, farming in New England slowly but steadily declined; around the turn of the century the cutting of the white pine that had seeded into the fields and pastures constituted the last major land clearing in southern and central New England. Once cut, most sites produced hardwoods, which in turn, as they grew from saplings to poles, produced high populations of ruffed grouse. The image of plentiful sport hunting opportunities for ruffed grouse remains etched in the popular perception of New England's woodlands even today.

Since about 1950, farming has declined dramatically, supplanted by suburban development; forests and woodlands have come to be viewed by many New Englanders as a "green backdrop" rather than a source of wood products. Recreational development and the second-home market in the 1960's and 70's brought many suburban New Englanders--who, commonly were unfamiliar with forest management and hunting--into more rural areas where timber harvesting was both accepted and economically very important.

During the 1960's and 70's federal statutes were introduced which focused planning requirements and management options on public lands; states also introduced legislation that affected the management of both state-administered public and private lands.

Today, even-age techniques, probably by virtue of large (especially public) holdings, are common in northern New England. A long history of local public acceptance of even-age management prevails. About 80 percent of northern New England is in hardwood and conifer forests, much in small holdings. Sawlogs and pulp are major products; maple syrup is produced locally. Also, in northern New England, hunting, logging and pulpwood productions, and second-home development are important. Hunting, especially for deer, is extensive.

Habitat conditions largely determine the wildlife species composition--the community--that can occupy that habitat. This workshop is an attempt to describe the wildlife species assemblages potentially occurring in New England forest habitats, and to present the silvicultural techniques or options needed to create or maintain their habitat conditions or key features in managed forests.

The New England Landscape

Geologically, New England is very old -- some of the oldest metamorphic rock formations in the world are found throughout the region. The mountains and upland plateaus are primarily composed of granite, gneisses, and schists. The bedrock is granitic and so contains a high proportion of quartz. Thus, generally, soils are moderately coarse textured, acidic, and of relatively low fertility. In the valleys, fine textured soils that have resulted from calcareous parent material are much more fertile.

The mountains of New England are eroded remnants of earlier cycles of uplift and erosion. Many occur as monadnocks -- peaks of resistant rock projecting above surrounding peneplains. The major mountain ranges are the Taconic Mountains and Berkshire Hills of western Massachusetts and northwestern Connecticut, the Green Mountains of Vermont and western Massachusetts, and the White Mountains of New Hampshire. The Presidential Range of the White Mountains, the highest range in the Northeast, includes Mt. Washington at 1,917 m (6,290 ft.) and four other peaks above 1,615 m (5,300 ft.).

Glaciation has produced profound changes, however, and the resultant manner in which the transported debris or drift was deposited largely determines soil fertility. Because soils did not develop in place, New England is not simply a region of infertile uplands grading into fertile valleys. Often the best soils for forest development consist of unsorted glacial drift (till) deposited by glacial withdrawal. Such soils are frequently found on midslopes of hills and mountains. Conversely, water-transported drift, frequently stratified and deposited in broad outwash plains and glacial lake shores, often produced poor soils at lower elevations.

Till soils throughout New England frequently contain a relatively impervious compact layer, or fragipan, several inches to a foot or more below the surface. Vernal pools, seeps, and wet ground, even on upper slopes, are common in spring due to the presence of this layer.

Disrupted drainage patterns, scoured-out glacial basins, and glacially dammed waterways have created many ponds and lakes. The melting of ice blocks, buried in glacial debris, created depressions that formed kettle-hole lakes, especially on Cape Cod. Wetlands and bogs have formed in smaller, shallow depressions.

STRUCTURAL HABITAT FEATURES AND WILDLIFE

The following section discusses the occurrence and distribution of wildlife species and structural habitat features within the various cover type groups in New England and examines any age/size class relationships that may exist for each group of structural habitat features.

High Exposed Perches

High exposed perching sites are most often found in old fields, pastures, new clearcuts, roadsides with grassy rights-of-way, water influence landscapes (riparian corridors), and other forested stands where an overstory tree clearly towers above all other forest vegetation or where a single tree or group of trees stands considerably above the surrounding herbaceous ground vegetation. Bull pines, supracanopy white pines and hemlock, lone pasture elms, leave trees as in red oak seed trees, and large roadside sugar maples are examples of high exposed perching sites. The exposed nature of these high perches provides excellent hunting sites for various raptors like osprey, bald eagle, and red-tailed hawk that forage in nonforested cover types and open canopied forest types; and small perching birds like the olive-sided flycatcher that hawk for insects above the stand canopy. These perches also provide suitable nest sites for the red-tailed hawk; and great blue heron, osprey, and bald eagle when in close proximity to water. In addition these perches serve as excellent loafing sites for turkey vultures and common ravens who can also scavenge from these perches if located near predictable sources of food. Wildlife species that use high exposed perching sites are:

Wildlife Species	Habitat Breadth Category
Great blue heron	Forest-Nonforest-Water
Turkey vulture	Forest-Nonforest
Osprey	Water
Bald eagle	Forest-Water
Red-tailed hawk	Forest-Nonforest
Rough-legged hawk	Nonforest
Olive-sided flycatcher	Forest-Nonforest
Common raven	Forest-Krummholz-Nonforest-Water

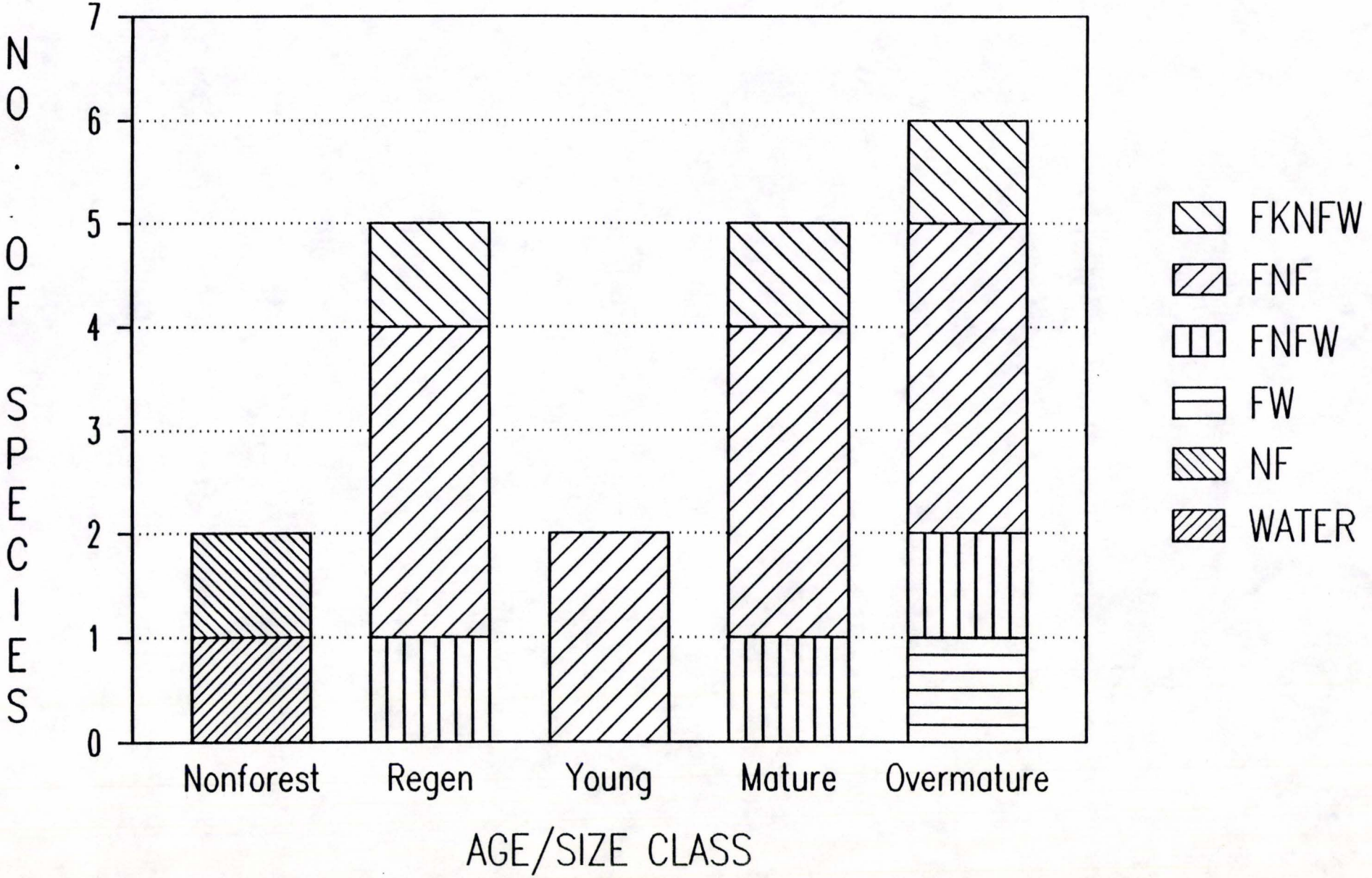
n = 8 species

Wildlife species use of high exposed perching sites is lowest in the young age/pole size classes (Figure A) and remains fairly constant in the other age/size classes and nonforested cover types. Pole size classes tend to be fairly uniform in distribution; lacking the relatively distinct vegetative layers that can be found in other age/size classes and nonforested cover types. Clearcut prescriptions for aspen-birch; open shelterwood prescriptions for northern hardwoods and oak-pine; and group selection prescriptions for northern hardwoods and spruce-fir, especially close to water and other nonforested cover types can provide such perching sites for immediate use by hunting hawks by retaining suitable wildlife trees. Long-term management of these habitat features would assure suitable nesting and perching sites for these types of wildlife species, some of which are either of special interest to the public or state/federally listed threatened or endangered wildlife species.

Figure A.

HIGH EXPOSED PERCH USE

by age/size class



Low Exposed Perches

Low exposed perches relative to the ground can be found in old fields, pastures, wetland nonforest cover types, water influence landscapes, roadside rights-of-way, landscaped backyards, and recent clearcuts. Low exposed perches can be fences, isolated deciduous shrubs, sprout clumps of advanced tree species regeneration, dead stubs less than 10 ft. high, or clearcutting residual (for example, slash). These low perches are suitable singing perches and insect hawking perches for the following species:

Wildlife Species	Habitat Breadth Category
Olive-sided flycatcher	Forest-Nonforest
Yellow-bellied flycatcher	Forest-Nonforest
Acadian flycatcher	Forest
Eastern phoebe	Forest-Nonforest
Eastern kingbird	Forest-Nonforest
Eastern bluebird	Forest-Nonforest
Northern mockingbird	Forest-Nonforest
Northern shrike	Forest-Nonforest
Loggerhead shrike	Forest-Nonforest
Northern cardinal	Forest-Nonforest-Water
Indigo bunting	Forest-Nonforest
Chipping sparrow	Forest-Nonforest
Field sparrow	Forest-Nonforest
Vesper sparrow	Nonforest
Grasshopper sparrow	Nonforest
Henslow's sparrow	Nonforest
Song sparrow	Forest-Nonforest
Eastern meadowlark	Nonforest
Cardinal	Forest-Nonforest

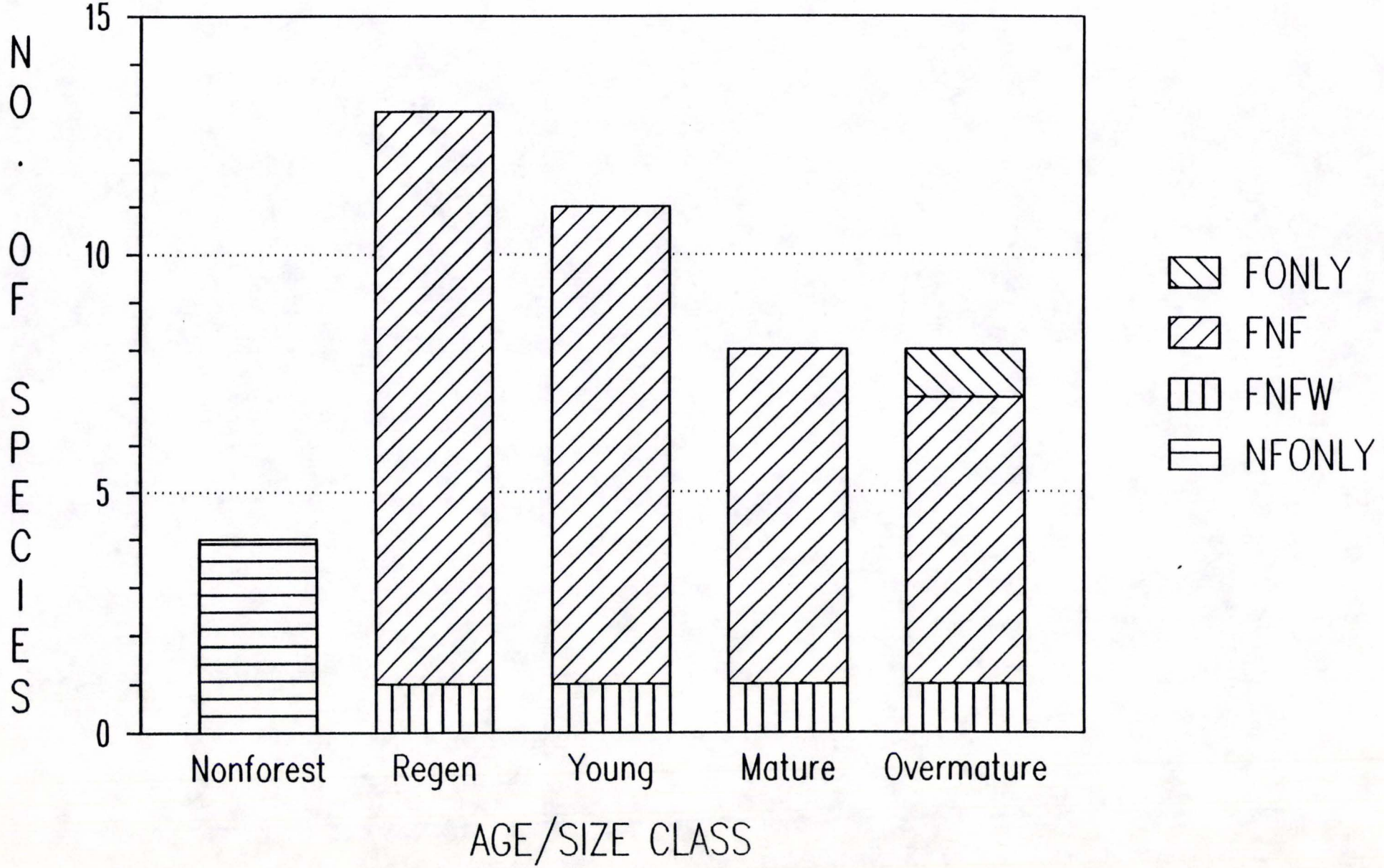
n = 19 species

Wildlife use of low exposed perches is highest in the regenerating age/seedling size classes and decreases with stand age/size class (Figure B).

Figure B.

LOW EXPOSED PERCH USE

by age/size class



Minimal Overstory Canopy Conditions

Minimal overstory canopy conditions can be described as those forested stands or nonforested cover types with overstory crown closures less than 15%. Minimal overstory canopy conditions can be found in abandoned fields and old pastures, sedge meadows, savannas, open bogs; commercially defined nonstocked forest stands and recently clearcut stands. Minimal overstory canopy conditions permit maximum amounts of sunlight to hit the ground with a resulting response in the ground vegetation layer. The open nature of these types of forested stands can provide the foraging and nesting habitat for wildlife species like:

Wildlife Species	Habitat Breadth Category
Osprey	Water
Bald eagle	Forest-Water
Northern harrier	Nonforest
Cooper's hawk	Forest-Nonforest
Red-tailed hawk	Forest-Nonforest
Rough-legged hawk	Nonforest
Golden eagle	Forest-Krummholz-Nonforest
American kestrel	Forest-Nonforest
Gray partridge	Nonforest
Ring-necked pheasant	Nonforest
Eastern screech owl	Forest-Nonforest
Snowy owl	Nonforest
Short-eared owl	Nonforest
Northern shrike	Forest-Nonforest
Loggerhead shrike	Forest-Nonforest
Nashville warbler	Forest-Nonforest
Yellow warbler	Forest-Nonforest
Prairie warbler	Forest-Nonforest
Yellow-breasted chat	Forest-Nonforest
Red-winged blackbird	Nonforest
Eastern meadowlark	Nonforest
Northern oriole	Forest-Nonforest
European hare	Forest-Nonforest
Woodchuck	Forest-Nonforest

n = 24 species

Wildlife use of minimal overstory canopy conditions is highest in the regenerating age/seedling size class (Figure C), where the overstory canopy usually is minimal; where clearcutting is a standard practice. In older and larger size class stands, minimal overstory canopy conditions usually exist in poorly stocked and commercially non-stocked forest stands, or where a low stocking level is desired for esthetic reasons.

Open Overstory Canopy Conditions

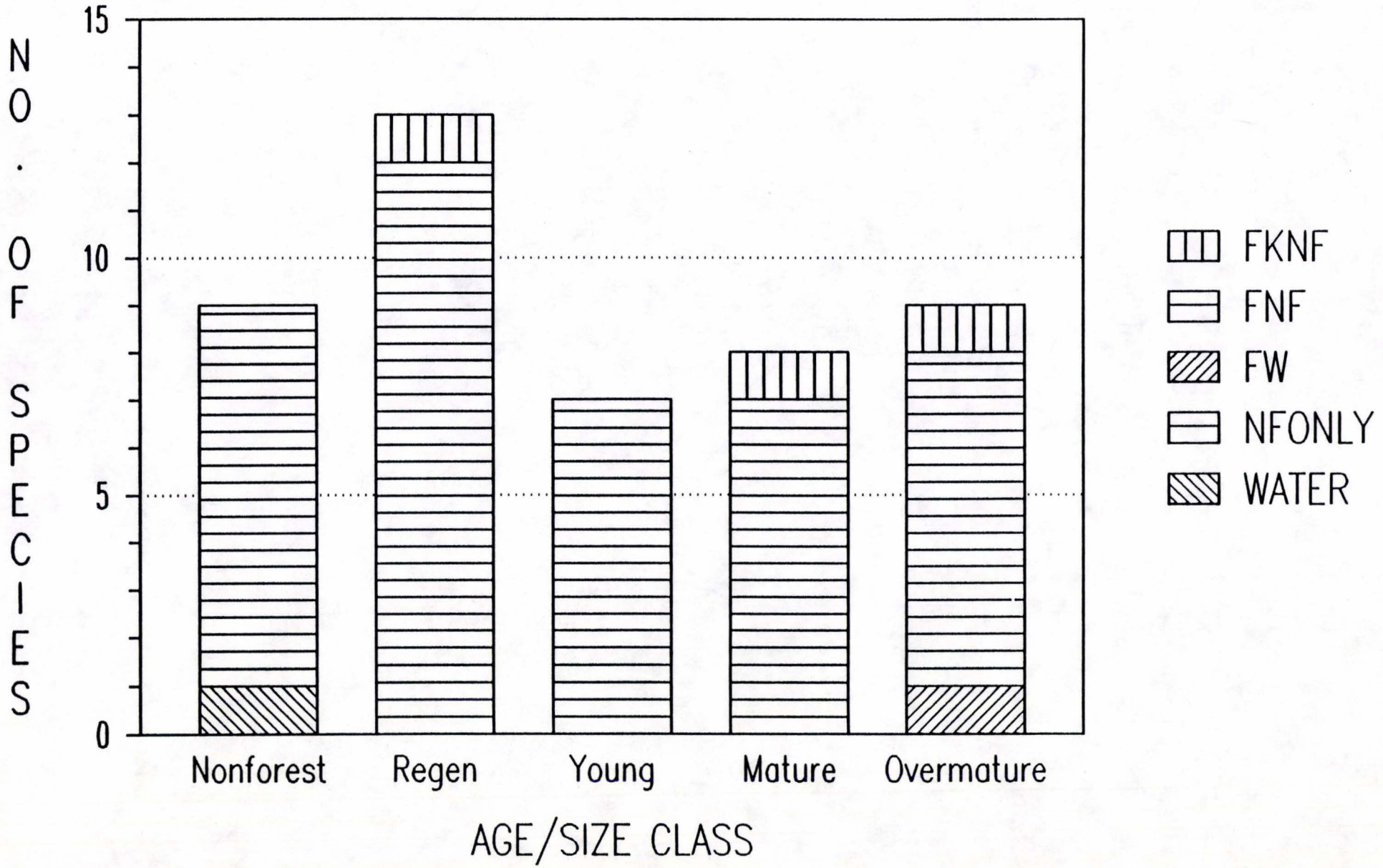
Open overstory canopy conditions can be described as those forested stands with overstory crown closures between 15 and 30%. Open overstory canopy conditions can occur in a number of forested cover type and age/size class situations, such as clearcuts, open shelterwoods, sugarbush stands, and low density pine stands. Open overstory canopy conditions many times are temporary until the overstory fills in over several growing seasons. Other structural habitat features associated with open overstory canopy conditions include developing shrub and midstory vegetation layers. Wildlife species that use open overstory canopy conditions are:

Wildlife Species	Habitat Breadth Category
Turkey vulture	Forest-Nonforest
Osprey	Water
Bald eagle	Forest-Water
Red-shouldered hawk	Forest-Nonforest
Golden eagle	Forest-Krummholz-Nonforest
Merlin	Forest-Nonforest
Ruffed grouse	Forest-Nonforest
Wild turkey	Forest-Nonforest
Northern bobwhite	Forest-Nonforest
American woodcock	Forest-Nonforest
Mourning dove	Forest-Nonforest
Black-billed cuckoo	Forest-Nonforest
Yellow-billed cuckoo	Forest-Nonforest
Eastern screech owl	Forest-Nonforest

Figure C.

MINIMAL CANOPY USE

by age/size class



Wildlife Species (continued)	Habitat Breadth Category
Great gray owl	Forest-Nonforest
Boreal owl	Forest-Nonforest
Northern-saw-whet owl	Forest-Nonforest
Common nighthawk	Forest-Nonforest
Red-headed woodpecker	Forest-Nonforest
Olive-sided flycatcher	Forest-Nonforest
Eastern kingbird	Forest-Nonforest
Eastern bluebird	Forest-Nonforest
Bohemian waxwing	Forest-Nonforest
Warbling vireo	Forest-Nonforest
Philadelphia vireo	Forest-Nonforest
Chipping sparrow	Forest-Nonforest
Orchard oriole	Forest-Nonforest

n = 27 species

Wildlife use of open overstory canopy conditions is highest in regenerating age/size class (Figure D).

Partial Overstory Canopy Conditions

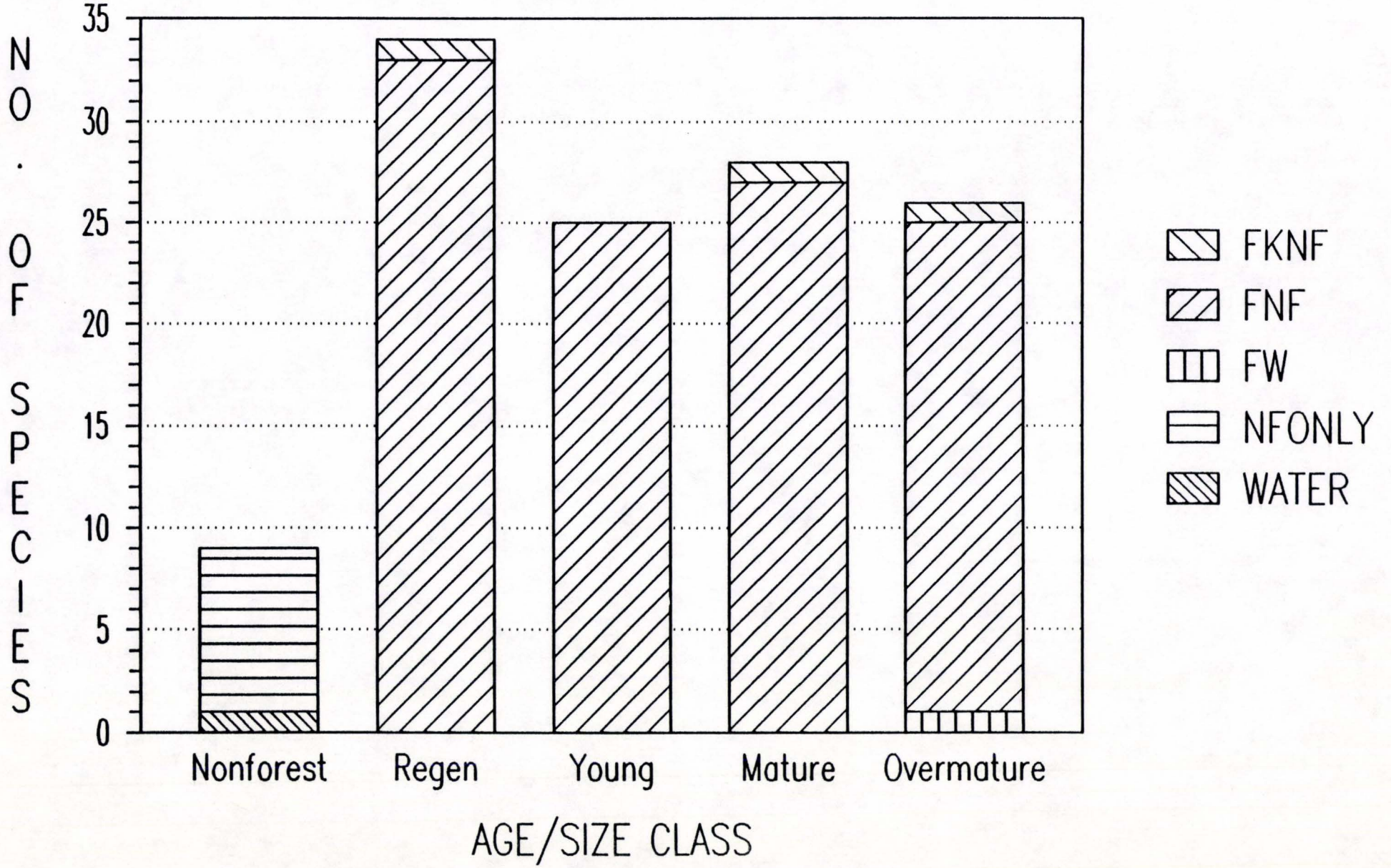
Partial overstory canopy conditions can be described as forested stands with overstory crown closures between 30 and 70%. As in the case of open canopy conditions, partial overstory crown closures can occur in a number of forested cover types and age/size class situations, such as intermediate thinnings and closed shelterwoods. Wildlife species that use partial overstory canopy conditions are:

Wildlife Species	Habitat Breadth Category
Turkey vulture	Forest-Nonforest
Cooper's hawk	Forest-Nonforest
Northern goshawk	Forest-Nonforest
Ruffed grouse	Forest-Nonforest
Wild turkey	Forest-Nonforest
Northern hawk-owl	Forest-Nonforest
Whip-poor-will	Forest-Nonforest
Ruby-throated hummingbird	Forest-Nonforest
Great crested flycatcher	Forest-Nonforest
Blue-gray gnatcatcher	Forest-Nonforest

Figure D.

OPEN CANOPY USE

by age/size class



Wildlife Species (continued)	Habitat Breadth Category
Veery	Forest-Nonforest
Hermit thrush	Forest-Nonforest
Solitary vireo	Forest
Yellow-throated vireo	Forest-Nonforest
Pine warbler	Forest
Hairy-tailed mole	Forest-Nonforest
Eastern pipistrelle	Forest-Nonforest-Water

n = 17 species

Wildlife use of partial overstory canopy conditions does not appear to vary within the various forest cover type and age/size class groups (Figure E).

Closed Overstory Canopy Conditions

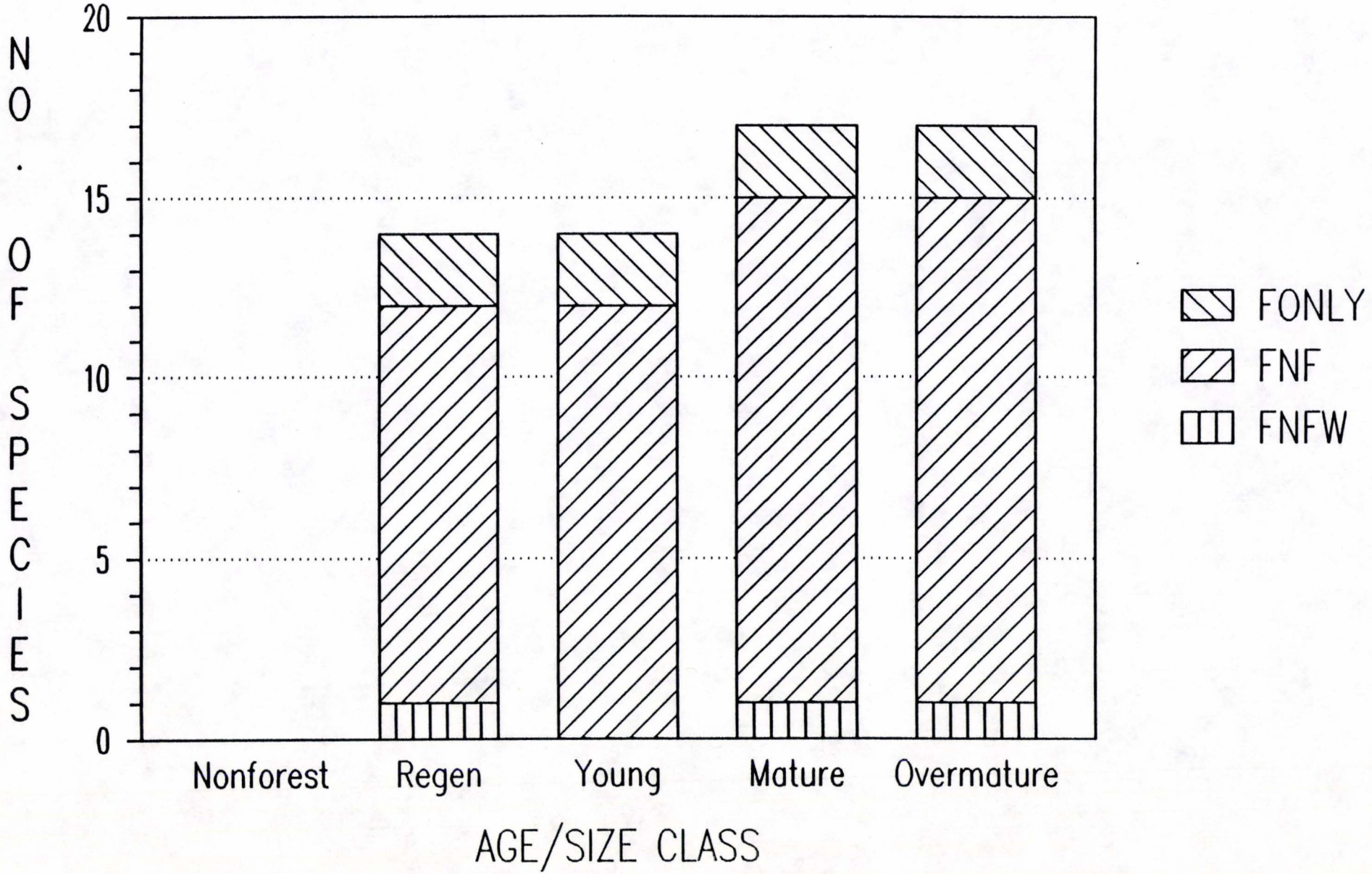
Closed overstory canopy conditions can be described as those forested stands with overstory crown closures greater than 70%. Closed overstory canopy conditions can occur in any number of forested cover type and age/size class situations, such as in unevenaged/unevensized management of northern hardwoods, and in evenaged management systems where stocking levels are maintained at these levels for maximum form, quality, and growth. Other structural habitat features associated with closed overstory canopy conditions include minimal development of shrub, midstory, and ground vegetation layers. Wildlife species that use closed overstory canopy conditions are:

Wildlife Species	Habitat Breadth Category
Bald eagle	Forest-Water
Sharp-shinned hawk	Forest-Nonforest
Northern goshawk	Forest-Nonforest
Red-shouldered hawk	Forest-Nonforest
Broad-winged hawk	Forest-Nonforest
Red-tailed hawk	Forest-Nonforest
Spruce-grouse	Forest-Krummholz-Nonforest

Figure E.

PARTIAL CANOPY USE

by age/size class



Wildlife Species (continued)	Habitat Breadth Category
Great horned owl	Forest-Nonforest
Barred owl	Forest-Nonforest-Water
Northern saw-whet owl	Forest-Nonforest
Eastern wood-pewee	Forest-Nonforest
Acadian flycatcher	Forest
Alder flycatcher	Forest-Nonforest
Least flycatcher	Forest-Nonforest
Golden-crowned kinglet	Forest-Krummholz
Ruby-crowned kinglet	Forest-Krummholz
Wood thrush	Forest
Red-eyed vireo	Forest-Nonforest
Northern parula	Forest-Nonforest
Cape May warbler	Forest
Black-throated blue warbler	Forest
Black-throated green warbler	Forest
Blackburnian warbler	Forest
Pine warbler	Forest
Cerulean warbler	Forest
Worm-eating warbler	Forest
Canada warbler	Forest-Nonforest
Scarlet tanager	Forest
Pine grosbeak	Forest-Krummholz-Nonforest
Pine siskin	Forest-Nonforest
Red bat	Forest-Nonforest-Water
Hoary bat	Forest-Nonforest-Water
White-tailed deer	Forest-Nonforest

n = 33 species

Wildlife use of closed overstory canopy conditions increases with age/size class groups (Figure F), whereas wildlife use of minimal overstory canopy conditions is greatest in the nonforested cover types and regenerating/seedling size class groups. The wildlife species assemblage that utilizes closed canopy situations is very different from the assemblage that uses the more open canopy conditions. There is some overlap of species using several canopy conditions, due to changes in seasonal feeding and shelter requirements.

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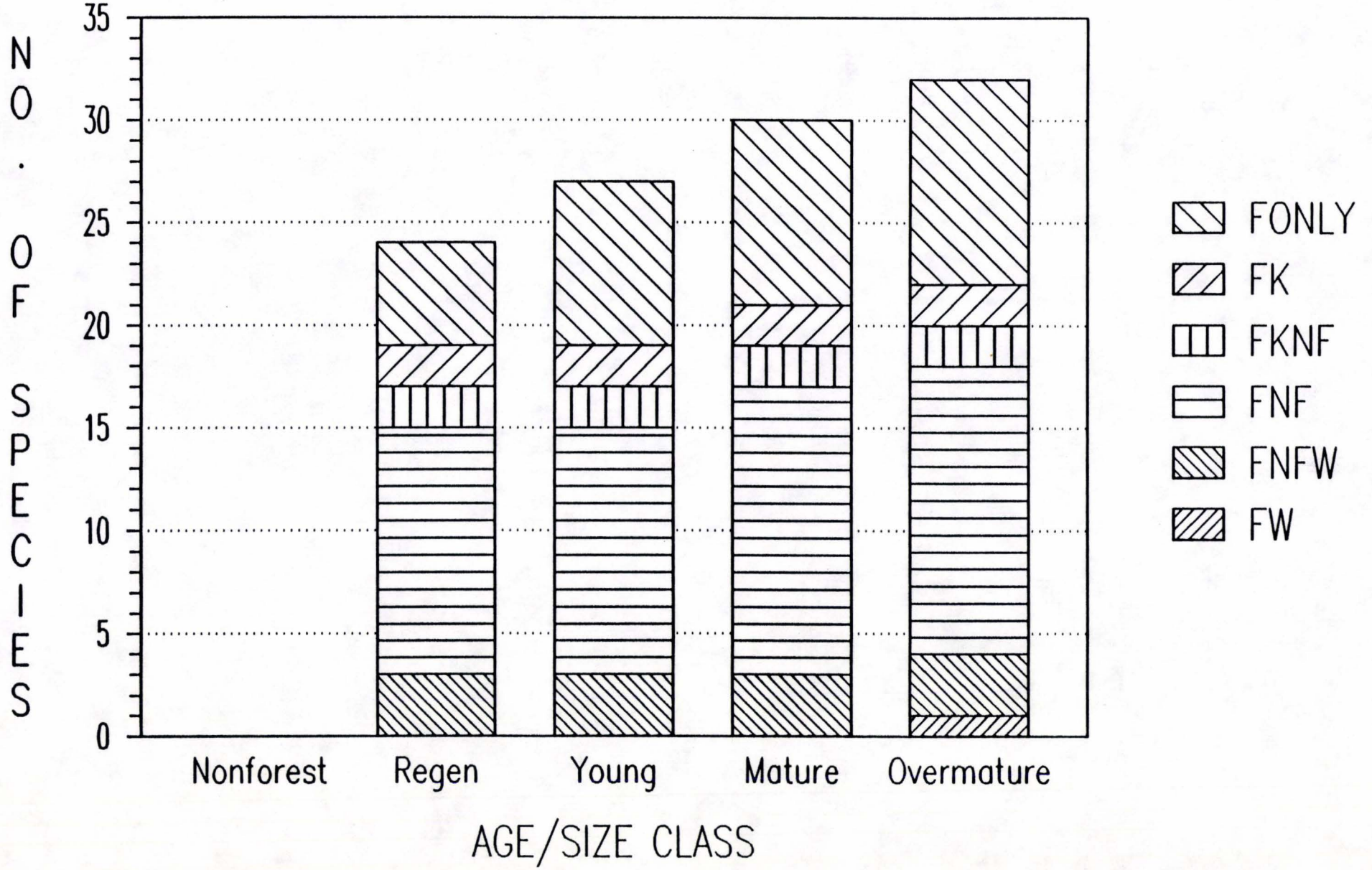
CLOSED CANOPY USE

by age/size class



Overstory Inclusions

The observation of overstory inclusions in forested stands depends on several factors; a minimum stand size and the level of detail in forest cover type mapping and inventory. Large minimum stand sizes (larger than 10 acres) tend to obscure the isolated patches of conifer stems in hardwood stands; or hardwood stems in conifer stands; especially where the cover types change as rapidly as they seem to across New England landscapes (every 5-10 acres). Mixed stand cover typing such as in aspen-fir-spruce, oak-pine, and northern hardwoods-hemlock, help identify large acreages where these conditions are present. Coniferous overstory inclusions of hemlock, spruce, fir, or pine can provide feeding, nesting and winter shelter opportunities in deciduous stands that pure hardwood stands can not provide. Likewise, deciduous overstory inclusions of oak, beech, and other hardwoods can provide mast and other foraging and nesting sites that pure conifer stands can not provide. Wildlife species that utilize these inclusions, sometimes just a group of several stems to 1/4 - 2 acres in size are:

Wildlife Species	Habitat Breadth Category
Sharp-shinned hawk	Forest-Nonforest
Cooper's hawk	Forest-Nonforest
Northern goshawk	Forest-Nonforest
Red-shouldered hawk	Forest-Nonforest
Broad-winged hawk	Forest-Nonforest
Red-tailed hawk	Forest-Nonforest
Ruffed grouse	Forest-Nonforest
Wild turkey	Forest-Nonforest
Eastern screech owl	Forest-Nonforest
Great horned owl	Forest-Nonforest
Barred owl	Forest-Nonforest-Water
Long-eared owl	Forest-Nonforest
Northern-saw-whet owl	Forest-Nonforest
Whip-poor-will	Forest-Nonforest
Yellow-bellied sapsucker	Forest-Nonforest

Wildlife Species (continued)	Habitat Breadth Category
Eastern wood-pewee	Forest-Nonforest
Least flycatcher	Forest-Nonforest
Eastern phoebe	Forest-Nonforest
Great crested flycatcher	Forest-Nonforest
Blue jay	Forest-Nonforest
American crow	Forest-Nonforest
Tufted titmouse	Forest-Nonforest
Red-breasted nuthatch	Forest-Krummholz-Nonforest
White-breasted nuthatch	Forest-Nonforest
Brown creeper	Forest-Nonforest
Golden-crowned kinglet	Forest-Krummholz
Ruby-crowned kinglet	Forest-Krummholz
Blue-gray gnatcatcher	Forest-Nonforest
Veery	Forest-Nonforest
Hermit thrush	Forest-Nonforest
Wood thrush	Forest
American robin	Forest-Krummholz-Nonforest
Solitary vireo	Forest
Yellow-throated vireo	Forest-Nonforest
Red-eyed vireo	Forest-Nonforest
Nashville warbler	Forest-Nonforest
Northern parula	Forest-Nonforest
Yellow warbler	Forest-Nonforest
Magnolia warbler	Forest
Black-throated blue warbler	Forest
Yellow-rumped warbler	Forest-Krummholz-Nonforest
Black-throated green warbler	Forest
Blackburnian warbler	Forest
Pine warbler	Forest
American redstart	Forest-Nonforest
Mourning warbler	Forest-Nonforest
Canada warbler	Forest-Nonforest
Scarlet tanager	Forest
Chipping sparrow	Forest-Nonforest
Dark-eyed junco	Forest-Krummholz-Nonforest
Rusty blackbird	Forest-Nonforest-Water
Common grackle	Forest-Nonforest-Water
Purple finch	Forest-Nonforest
House finch	Forest-Nonforest
Pine siskin	Forest-Nonforest
American goldfinch	Forest-Nonforest
Evening grosbeak	Forest-Nonforest
Smokey shrew	Forest-Nonforest
Short-tailed shrew	Forest-Krummholz-Nonforest
Gray squirrel	Forest
Red squirrel	Forest-Krummholz
Deer mouse	Forest-Krummholz-Nonforest
Southern red-backed vole	Forest-Krummholz-Nonforest
Porcupine	Forest-Krummholz-Nonforest
White-tailed deer	Forest-Nonforest

n = 65 species

Wildlife use of overstory coniferous/deciduous inclusions increases with age/size class groups (Figure G).

Tree Boles

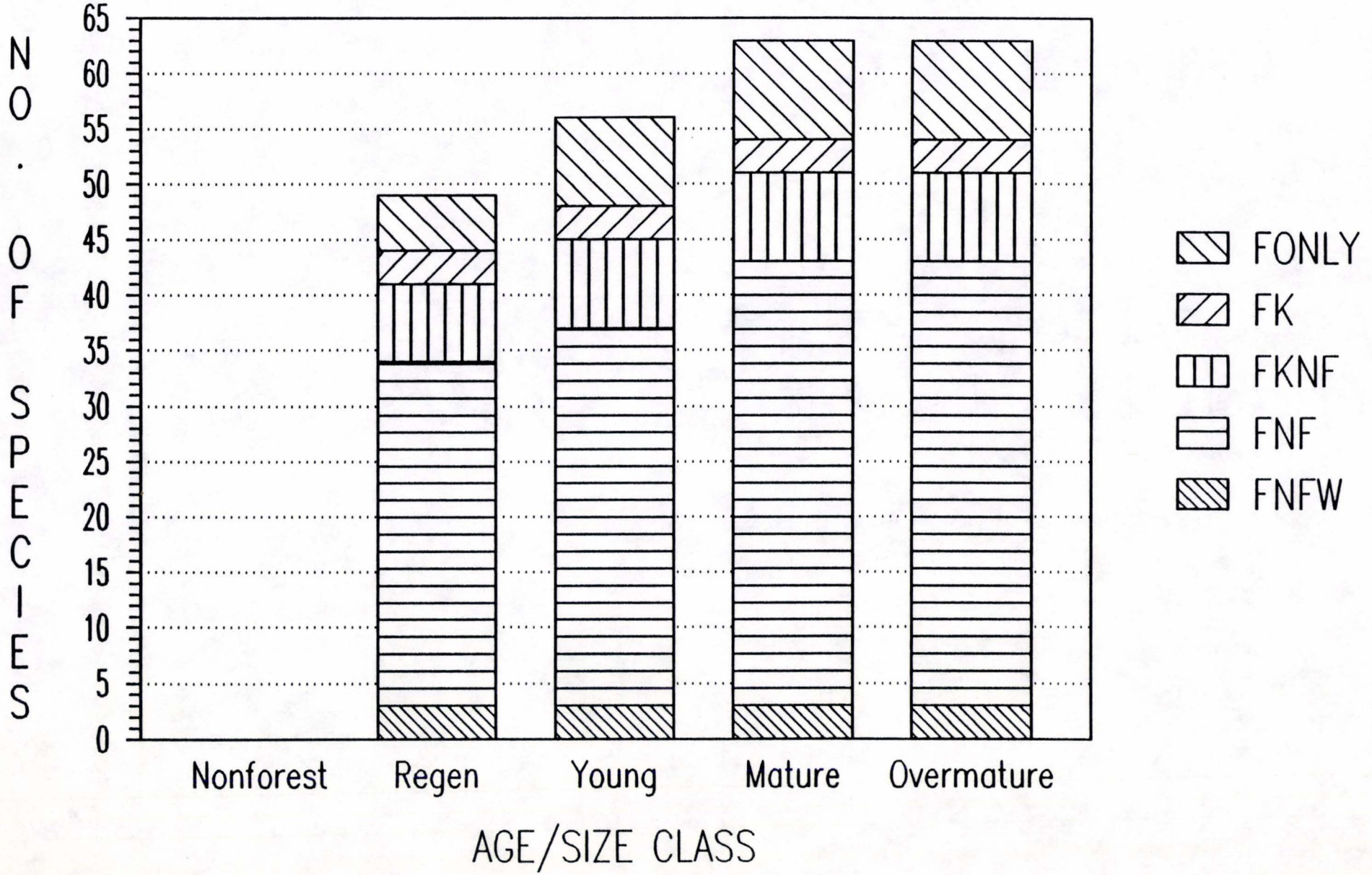
Trees with cavities can be found anywhere; in upland openings and old pastures; in riparian corridors, sedge meadows and open bogs; in addition to all forest cover type and age/size class groups. Cavities in stems less than 6 inches dbh are used by black-capped chickadees, bluebirds and tufted titmouse. Larger bodied birds and mammals like pileated woodpecker, fisher, and raccoon require larger cavities in stems usually greater than 18 inches dbh. Hollow stems larger than 18 inches dbh are good denning sites for porcupine, gray fox, black bear, and good roosting areas for little brown myotis and big brown bat. Usable cavities can be found in dead limbs of live trees, in addition to totally dead and dying stems. Feeding sites abound on tree boles; for example, pileated woodpeckers excavate carpenter ant galleries and yellow-bellied sapsuckers drill sapholes in yellow birch and glean the insects that visit the sapholes. Wildlife species that use tree boles large and small, near water and regardless of water, for shelter or feeding sites are:

Wildlife Species	Habitat Breadth Category
Wood duck	Forest-Nonforest-Water
Common goldeneye	Forest-Nonforest-Water
Hooded merganser	Forest-Nonforest-Water
Common merganser	Forest-Nonforest-Water
Turkey vulture	Forest-Nonforest
American kestrel	Forest-Nonforest
Merlin	Forest-Nonforest
Common barn owl	Nonforest
Eastern screech owl	Forest-Nonforest
Barred owl	Forest-Nonforest-Water
Boreal owl	Forest-Nonforest

Figure G.

OVERSTORY INCLUSION USE

by age/size class



Wildlife Species (continued)	Habitat Breadth Category
Northern saw-whet owl	Forest-Nonforest
Red-headed woodpecker	Forest-Nonforest
Red-bellied woodpecker	Forest-Nonforest
Yellow-bellied sapsucker	Forest-Nonforest
Downy woodpecker	Forest-Nonforest
Hairy woodpecker	Forest-Nonforest
Three-toed woodpecker	Forest-Nonforest
Black-backed woodpecker	Forest-Nonforest
Northern flicker	Forest-Nonforest
Pileated woodpecker	Forest
Great crested flycatcher	Forest-Nonforest
Purple martin	Forest-Nonforest-Water
Tree swallow	Forest-Nonforest-Water
Black-capped chickadee	Forest-Krummholz-Nonforest
Boreal chickadee	Forest-Krummholz-Nonforest
Tufted titmouse	Forest-Nonforest
Red-breasted nuthatch	Forest-Krummholz-Nonforest
White-breasted nuthatch	Forest-Nonforest
Brown creeper	Forest-Nonforest
House wren	Forest-Nonforest
Winter wren	Forest-Nonforest
Eastern bluebird	Forest-Nonforest
European starling	Forest-Nonforest
Prothonotary warbler	Forest-Nonforest
Virginia opossum	Forest-Nonforest
Little brown myotis	Forest-Nonforest-Water
Keen's myotis	Forest-Nonforest-Water
Indiana myotis	Forest-Nonforest-Water
Silver-haired bat	Forest-Nonforest-Water
Big brown bat	Forest-Nonforest-Water
Gray Squirrel	Forest
Red squirrel	Forest-Krummholz
Southern flying squirrel	Forest-Nonforest
Northern flying squirrel	Forest
Porcupine	Forest-Krummholz-Nonforest
Gray fox	Forest-Nonforest
Black bear	Forest-Nonforest-Water
Raccoon	Forest-Nonforest
Marten	Forest-Krummholz
Fisher	Forest-Krummholz-Nonforest
Ermine	Forest-Nonforest
Long-tailed weasel	Forest-Nonforest

n = 53 species

Wildlife use of all sizes and conditions of tree boles increases with age/size class groups (Figure H). Several wildlife species that use tree cavities in nonforested areas include common barn owl, tree swallow, and eastern bluebird. The presence of water is an important habitat factor to cavity dwelling species like wood duck, common goldeneye, hooded merganser, common merganser, purple martin, tree swallow, little brown myotis, Keen's myotis, Indiana myotis, silver-haired bat, and big brown bat. It appears that stands with larger average stand diameters, a variety of tree conditions (including dead stems; and live trees with hollow stems, dead limbs, and suppressed small diameter trees), and nearby water have the higher habitat potentials for cavity dwelling wildlife species in New England.

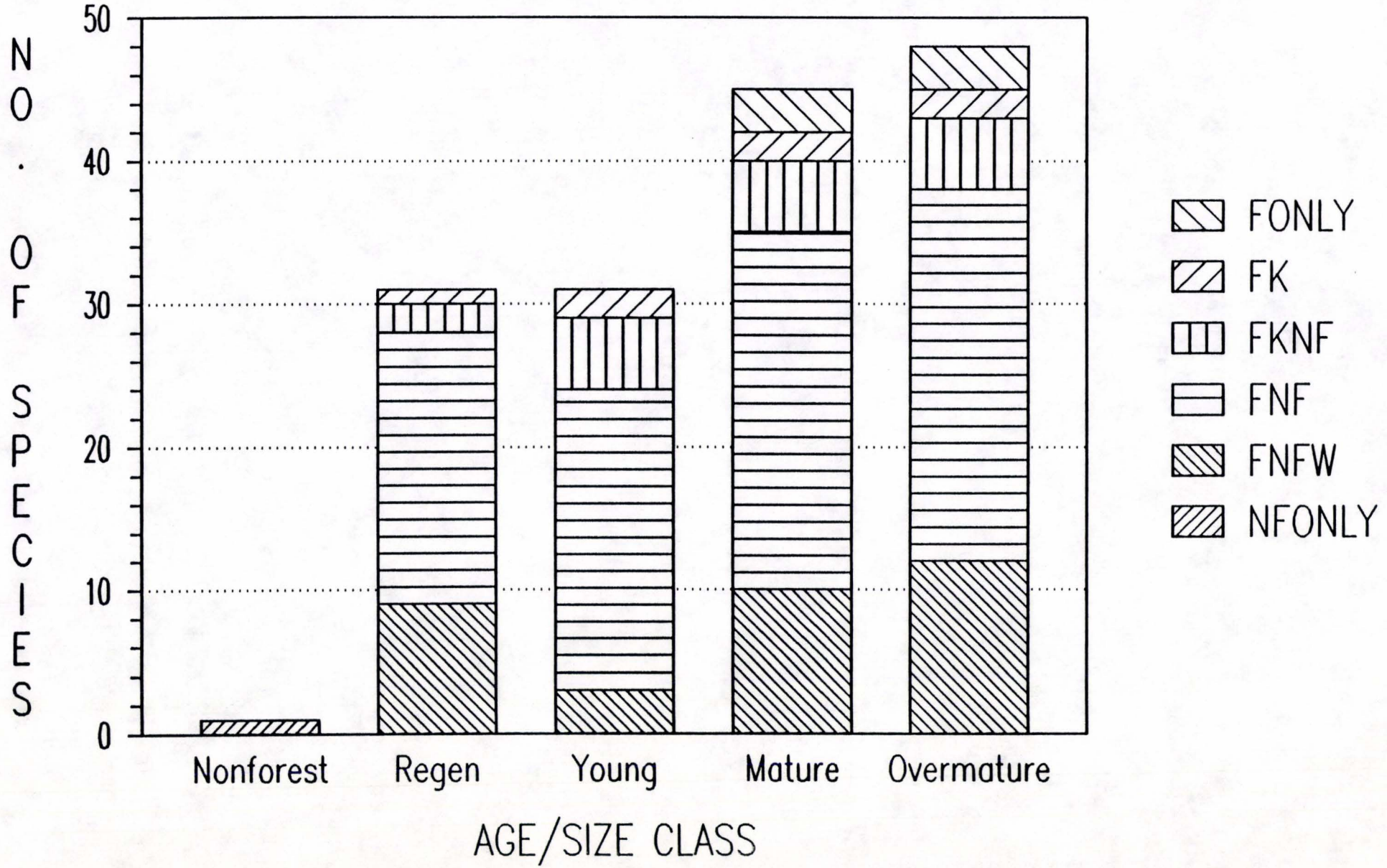
Midstory Layer

The midstory layer can be described as the deciduous and coniferous saplings and poles that occur within the 10-30' zone in forested stands and occasionally in some nonforested cover types; and usually beneath an overstory canopy. Wildlife species that use a deciduous, coniferous, or mixed midstory layer in which to nest or forage can also find suitable conditions in certain krummholz, and nonforest cover type conditions. Wildlife species that are associated with a midstory layer are:

Figure H.

TREE BOLE USE

by age/size class



Wildlife Species	Habitat Breadth Category
Acadian flycatcher	Forest
Gray jay	Forest-Krummholz
Veery	Forest-Nonforest
Gray-cheeked thrush	Forest-Krummholz
Swainson's thrush	Forest
Wood thrush	Forest
White-eyed vireo	Forest-Nonforest
Solitary vireo	Forest
Philadelphia vireo	Forest-Nonforest
Golden-winged warbler	Forest-Nonforest
Northern parula	Forest-Nonforest
Magnolia warbler	Forest
Yellow-rumped warbler	Forest-Krummholz-Nonforest
Black-throated green warbler	Forest
Prairie warbler	Forest-Nonforest
Bay-breasted warbler	Forest-Nonforest
Blackpoll warbler	Forest-Krummholz
American redstart	Forest-Nonforest
Worm-eating warbler	Forest
Wilson's warbler	Forest-Nonforest
Lincoln's sparrow	Forest-Nonforest
Rusty blackbird	Forest-Nonforest-Water
Pine grosbeak	Forest-Krummholz-Nonforest
Red crossbill	Forest-Krummholz
White-winged crossbill	Forest-Krummholz
Pine siskin	Forest-Nonforest

n = 26 species

Wildlife use of a midstory layer is fairly constant throughout the forest cover type age/size class groups (Figure I).

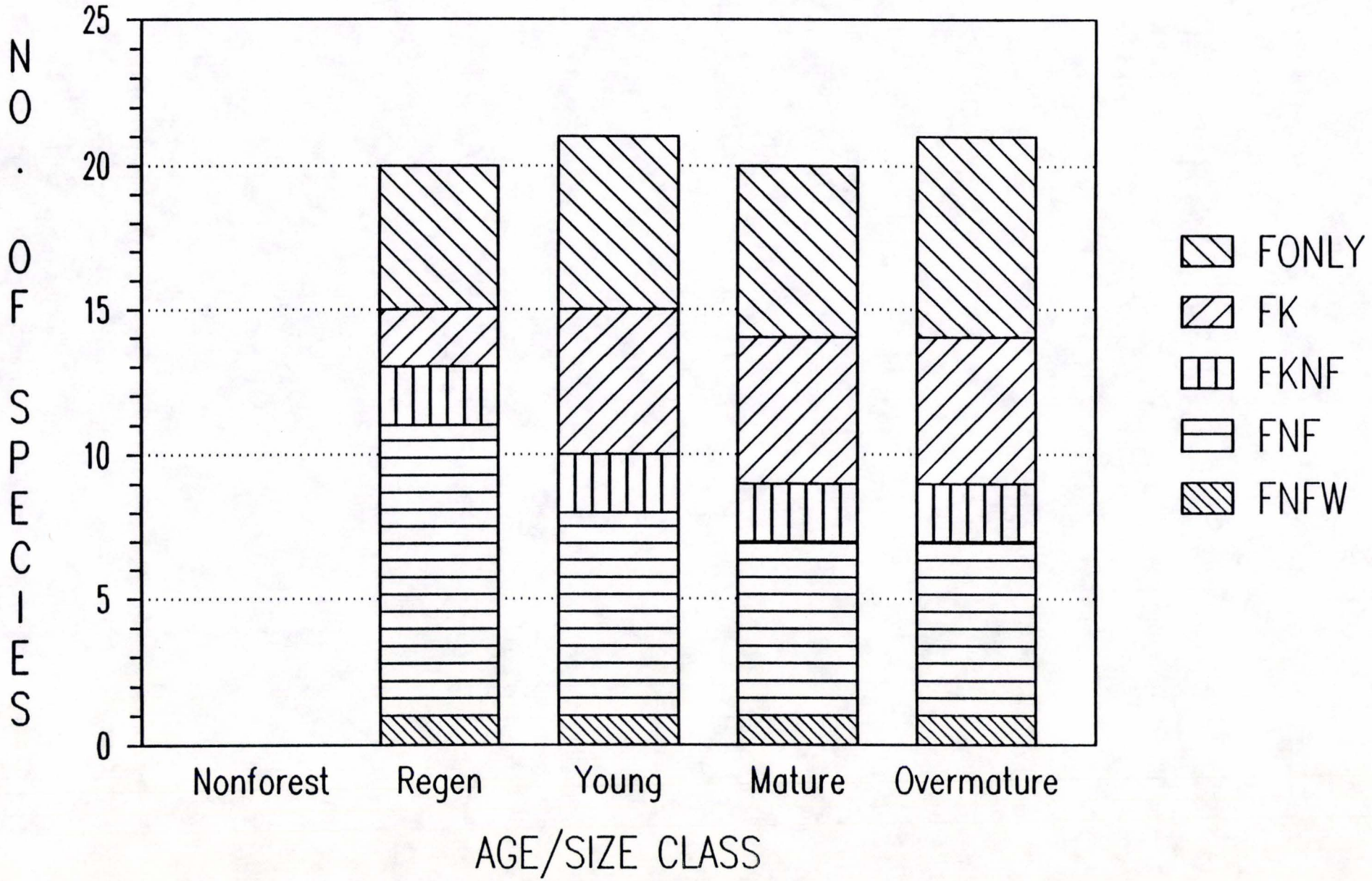
Shrub Layer

A shrub layer can be described as the deciduous, coniferous, and ericaceous shrubs and seedlings that occur within the 2-10' zone in forested and nonforested cover types; usually but not always with an overstory canopy present. Wildlife species that utilize shrub layers, whether in forested or nonforested cover types are:

Figure I.

MIDSTORY LAYER USE

by age/size class



Wildlife Species	Habitat Breadth Category
Marbled salamander	Forest-Nonforest-Water
Jefferson salamander	Forest-Nonforest
Blue-spotted salamander	Forest-Nonforest
Spotted salamander	Forest-Nonforest-Water
Red-spotted newt	Forest-Krummholz-Nonforest-Water
Northern dusky salamander	Forest-Krummholz-Nonforest-Water
Redback salamander	Forest-Nonforest
Slimy salamander	Forest-Nonforest
Four-toed salamander	Forest-Nonforest-Water
Northern spring salamander	Forest-Nonforest-Water
Northern two-lined salamander	Forest-Nonforest-Water
Eastern spadefoot	Forest-Nonforest
American toad	Forest-Nonforest-Water
Northern spring peeper	Forest-Nonforest-Water
Grey treefrog	Forest-Nonforest-Water
Green frog	Forest-Nonforest-Water
Mink frog	Forest-Nonforest-Water
Wood frog	Forest-Krummholz-Nonforest-Water
Pickerel frog	Forest-Nonforest-Water
Snapping turtle	Forest-Nonforest-Water
Stinkpot	Nonforest-Water
Spotted turtle	Nonforest-Water
Bog turtle	Forest-Nonforest-Water
Wood turtle	Forest-Nonforest-Water
Eastern box turtle	Forest-Nonforest-Water
Map turtle	Nonforest-Water
Eastern painted turtle	Forest-Nonforest-Water
Midland painted turtle	Nonforest-Water
Blanding's turtle	Nonforest-Water
Northern water snake	Forest-Nonforest-Water
Northern brown snake	Forest-Nonforest
Northern redbelly snake	Forest-Krummholz-Nonforest
Eastern garter snake	Forest-Krummholz-Nonforest-Water
Maritime garter snake	Krummholz-Nonforest-Water
Eastern hognose snake	Forest-Nonforest
Northern black racer	Forest-Nonforest
Eastern smooth green snake	Forest-Krummholz-Nonforest
Black rat snake	Forest-Krummholz-Nonforest
Northern cooperhead	Forest-Krummholz-Nonforest-Water
Common loon	Nonforest-Water
American bittern	Nonforest-Water
Least bittern	Nonforest
Great blue heron	Forest-Nonforest-Water
Green-backed heron	Forest-Nonforest-Water
Glossy ibis	Nonforest
Canada goose	Nonforest-Water
American black duck	Forest-Nonforest-Water
Mallard	Nonforest-Water
Northern pintail	Nonforest
Ring-necked duck	Nonforest-Water
Northern harrier	Nonforest

Wildlife Species (continued)	Habitat Breadth Category
Sharp-shinned hawk	Forest-Nonforest
Northern goshawk	Forest-Nonforest
Red-shouldered hawk	Forest-Nonforest
Rough-legged hawk	Nonforest
American kestrel	Forest-Nonforest
Merlin	Forest-Nonforest
Ring-necked pheasant	Nonforest
Wild turkey	Forest-Nonforest
Northern bobwhite	Forest-Nonforest
Common snipe	Nonforest
American woodcock	Forest-Nonforest
Mourning dove	Forest-Nonforest
Black-billed cuckoo	Forest-Nonforest
Yellow-billed cuckoo	Forest-Nonforest
Eastern screech owl	Forest-Nonforest
Great horned owl	Forest-Nonforest
Northern hawk-owl	Forest-Nonforest
Great gray owl	Forest-Nonforest
Long-eared owl	Forest-Nonforest
Boreal owl	Forest-Nonforest
Whip-poor-will	Forest-Nonforest
Ruby-throated hummingbird	Forest-Nonforest
Northern flicker	Forest-Nonforest
Olive-sided flycatcher	Forest-Nonforest
Yellow-bellied flycatcher	Forest-Nonforest
Acadian flycatcher	Forest
Alder flycatcher	Forest-Nonforest
Willow flycatcher	Forest-Nonforest
Eastern kingbird	Forest-Nonforest
Black-capped chickadee	Forest-Krummholz-Nonforest
Carolina wren	Forest-Nonforest
House wren	Forest-Nonforest
Winter wren	Forest-Nonforest
Blue-gray gnatcatcher	Forest-Nonforest
E. bluebird	Forest-Nonforest
Veery	Forest-Nonforest
Gray-cheeked thrush	Forest-Krummholz
Swainson's thrush	Forest
Hermit thrush	Forest-Nonforest
Wood thrush	Forest
Gray catbird	Forest-Nonforest
Northern mockingbird	Forest-Nonforest
Brown thrasher	Forest-Nonforest
Bohemian waxwing	Forest-Nonforest
Cedar waxwing	Forest-Nonforest
Northern shrike	Forest-Nonforest
Loggerhead shrike	Forest-Nonforest
White-eyed vireo	Forest-Nonforest
Solitary vireo	Forest
Philadelphia vireo	Forest-Nonforest
Blue-winged warbler	Forest-Nonforest

Wildlife Species (continued)	Habitat Breadth Category
Golden-winged warbler	Forest-Nonforest
Tennessee warbler	Forest-Nonforest
Nashville warbler	Forest-Nonforest
Yellow warbler	Forest-Nonforest
Chestnut-sided warbler	Forest-Nonforest
Magnolia warbler	Forest
Black-throated blue warbler	Forest
Yellow-rumped warbler	Forest-Krummholz-Nonforest
Prairie warbler	Forest-Nonforest
Palm warbler	Forest-Nonforest
Bay-breasted warbler	Forest-Nonforest
Blackpoll warbler	Forest-Krummholz
American redstart	Forest-Nonforest
Worm-eating warbler	Forest
Northern waterthrush	Forest-Nonforest-Water
Louisiana waterthrush	Forest-Nonforest
Mourning warbler	Forest-Nonforest
Common yellowthroat	Forest-Nonforest
Hooded warbler	Forest-Nonforest
Wilson's warbler	Forest-Nonforest
Canada warbler	Forest-Nonforest
Yellow-breasted chat	Forest-Nonforest
Northern cardinal	Forest-Nonforest-Water
Rose-breasted grosbeak	Forest-Nonforest
Indigo bunting	Forest-Nonforest
Rufous-sided towhee	Forest-Nonforest
American tree sparrow	Forest-Nonforest
Chipping sparrow	Forest-Nonforest
Field sparrow	Forest-Nonforest
Fox sparrow	Forest-Nonforest
Song sparrow	Forest-Nonforest
Lincoln's sparrow	Forest-Nonforest
Swamp sparrow	Forest-Nonforest
White-throated sparrow	Forest-Krummholz-Nonforest
Dark-eyed junco	Forest-Krummholz-Nonforest
Red-winged blackbird	Nonforest
Rusty blackbird	Forest-Nonforest-Water
Common grackle	Forest-Nonforest-Water
Pine grosbeak	Forest-Krummholz-Nonforest
Common redpoll	Forest-Nonforest
Hoary redpoll	Forest-Nonforest
Pine siskin	Forest-Nonforest
American goldfinch	Forest-Nonforest
Virginia opossum	Forest-Nonforest
Masked shrew	Forest-Krummholz-Nonforest
Water shrew	Forest-Nonforest-Water
Smokey shrew	Forest-Nonforest
Short-tailed shrew	Forest-Krummholz-Nonforest
Least shrew	Forest-Nonforest
Hairy-tailed mole	Forest-Nonforest
Eastern mole	Forest-Nonforest
Star-nosed mole	Forest-Nonforest-Water

Wildlife Species (continued)	Habitat Breadth Category
Hoary bat	Forest-Nonforest-Water
Eastern cottontail	Forest-Nonforest
New England cottontail	Forest-Nonforest
Snowshoe hare	Forest-Krummholz-Nonforest
Eastern chipmunk	Forest-Krummholz-Nonforest
Woodchuck	Forest-Nonforest
White-footed mouse	Forest-Krummholz-Nonforest
Southern red-backed vole	Forest-Krummholz-Nonforest
Meadow vole	Forest-Nonforest
Woodland vole	Forest-Nonforest
Southern bog lemming	Forest-Krummholz-Nonforest
Northern bog lemming	Forest-Krummholz-Nonforest
Meadow jumping mouse	Forest-Nonforest
Woodland jumping mouse	Forest-Nonforest
Coyote	Forest-Krummholz-Nonforest
Red fox	Forest-Krummholz-Nonforest
Black bear	Forest-Nonforest-Water
Raccoon	Forest-Nonforest
Ermine	Forest-Nonforest
Long-tailed weasel	Forest-Nonforest
Mink	Forest-Nonforest-Water
Lynx	Forest-Krummholz-Nonforest
Bobcat	Forest-Krummholz-Nonforest
White-tailed deer	Forest-Nonforest
Moose	Forest-Krummholz-Nonforest-Water

n = 180 species

Wildlife use of shrub layer whether for foraging, nesting, or hiding; is highest in regenerating age/seedling size class. Wildlife use of a shrub layer declines slightly and remains even in the older and larger age/size class groups (Figure J).

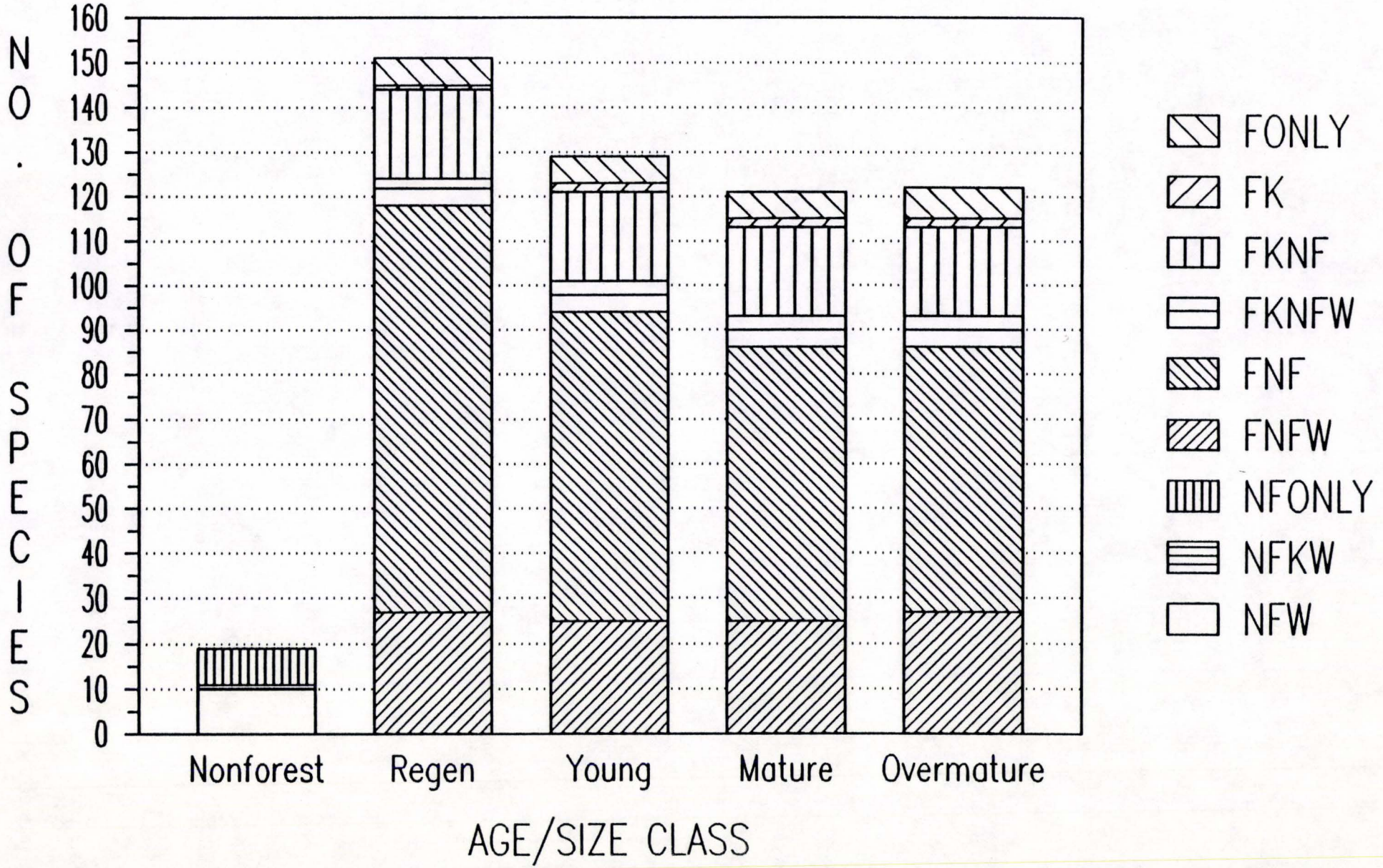
Wetland Shrub Layer

A wetland shrub layer can be described as the deciduous and ericaceous shrubs that occur within the 2-10' zone in forested and wetland nonforest cover types; usually but not always, beneath minimal overstory canopy conditions. Nonforest cover types where Salix sp., Cornus sp., Alnus sp., bog laurel and labrador tea are found; are examples of wetland shrub layer conditions that are used by the following wildlife species:

Figure J.

SHRUB LAYER USE

by age/size class

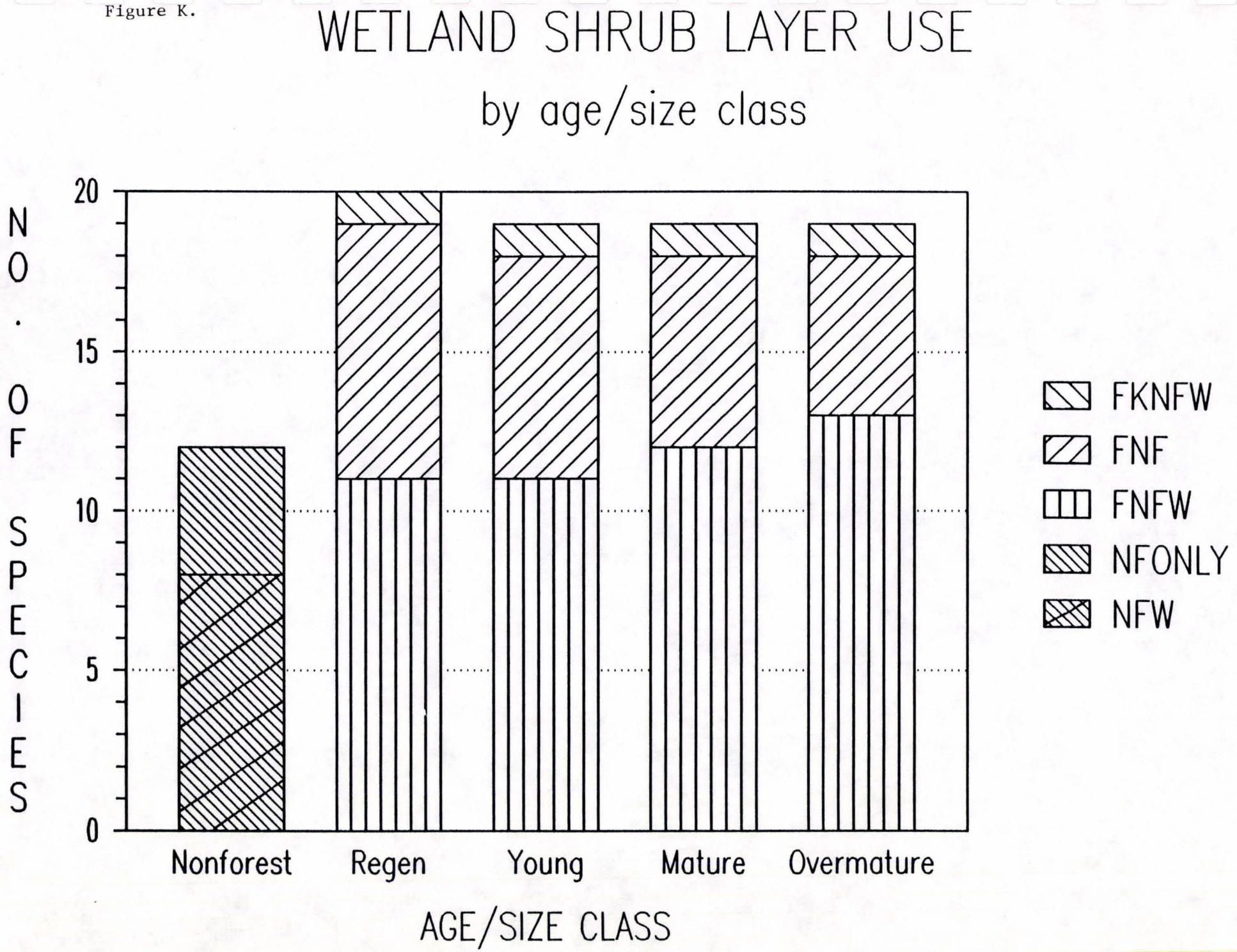


Wildlife Species	Habitat Breadth Category
Marbled salamander	Forest-Nonforest-Water
Jefferson salamander	Forest-Nonforest
Northern dusky salamander	Forest-Krummholz-Nonforest-Water
Bullfrog	Forest-Nonforest-Water
Pickerel frog	Forest-Nonforest-Water
Spotted turtle	Nonforest-Water
Wood turtle	Forest-Nonforest-Water
Eastern ribbon snake	Forest-Nonforest-Water
Common loon	Nonforest-Water
Green-backed heron	Forest-Nonforest-Water
Black-crowned night heron	Nonforest-Water
Yellow-crowned night heron	Nonforest-Water
Glossy ibis	Nonforest
Wood duck	Forest-Nonforest-Water
American black duck	Forest-Nonforest-Water
Blue-winged teal	Nonforest
Gadwall	Nonforest-Water
Ring-necked duck	Nonforest-Water
Common merganser	Forest-Nonforest-Water
Red-breasted merganser	Nonforest-Water
Northern harrier	Nonforest
Ruffed grouse	Nonforest
Spotted sandpiper	Nonforest-Water
Common snipe	Nonforest
American woodcock	Forest-Nonforest
Northern waterthrush	Forest-Nonforest-Water
Louisiana waterthrush	Forest-Nonforest
Canada warbler	Forest-Nonforest
Swamp sparrow	Forest-Nonforest
Water shrew	Forest-Nonforest-Water
New England cottontail	Forest-Nonforest
Raccoon	Forest-Nonforest
Mink	Forest-Nonforest-Water
River otter	Forest-Nonforest-Water

n = 34 species

Wildlife use of shrub layers commonly found in wet areas (Figure K) is similar, since most of these shrub species can be found in the understory of most types that occur on imperfectly drained soils.

Figure K.


WETLAND SHRUB LAYER USE
by age/size class
NO. OF SPECIES
20
15
10
5
0
Nonforest
Regen
Young
Mature
Overmature
AGE/SIZE CLASS
FKNFW
FNF
FNFW
NFONLY
NFW

Partial Herbaceous Coverage

Partial ground coverage of the herbaceous layer can be described as the forbs, grasses, and woody seedlings that occur in the 0-2' zone in forest and nonforest cover types; usually within a coverage range of 30-75%. Wildlife species that appear to use some herbaceous ground cover (Figure L) but not a lush thick stand of herbaceous vegetation are:

Wildlife Species	Habitat Breadth Category
Green-backed heron	Forest-Nonforest-Water
Common snipe	Nonforest
Whip-poor-will	Forest-Nonforest
Eastern wood-pewee	Forest-Nonforest
Least flycatcher	Forest-Nonforest
Northern waterthrush	Forest-Nonforest-Water
Louisiana waterthrush	Forest-Nonforest

n = 7 species

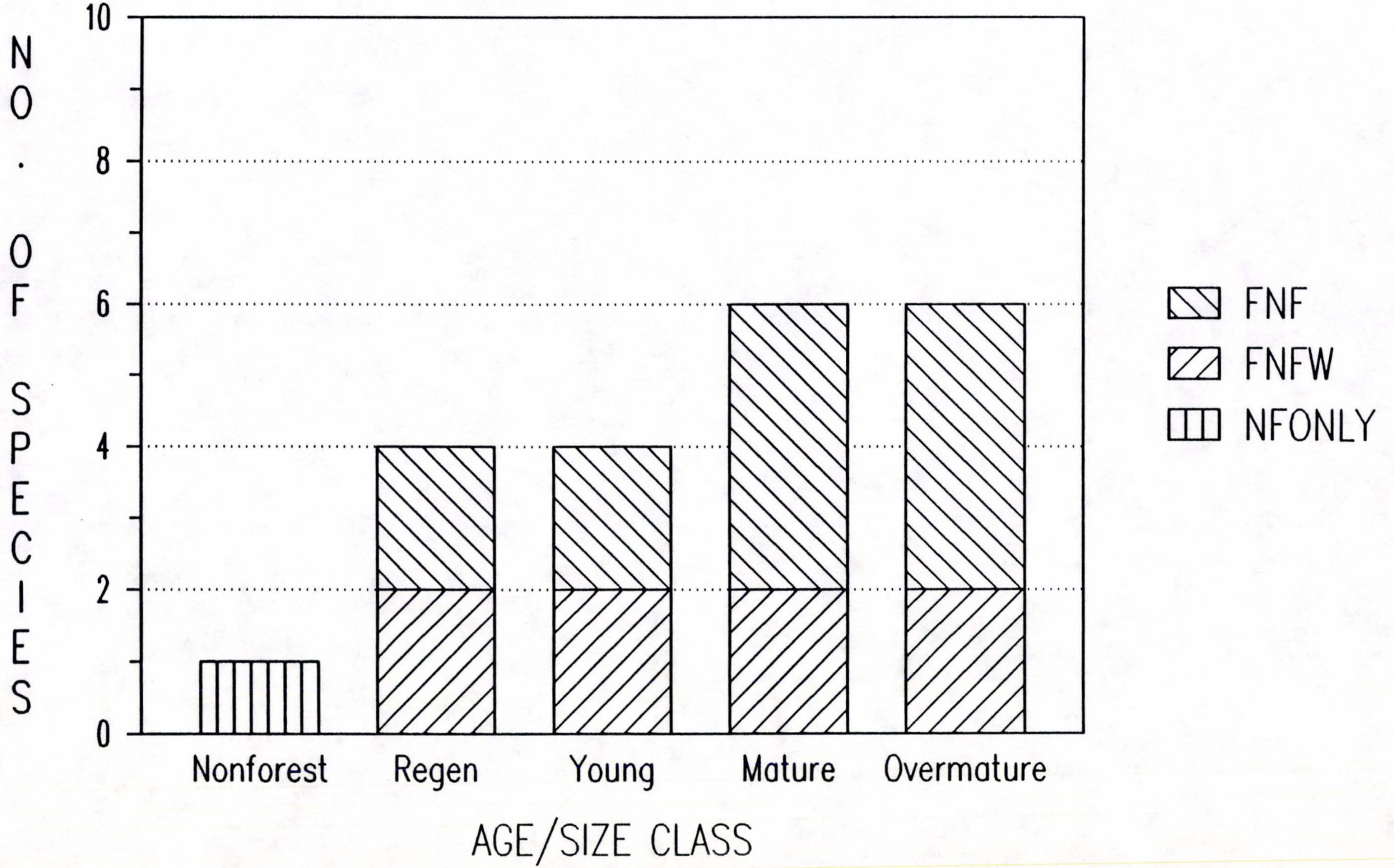
Full Herbaceous Coverage

Full ground coverage of the herbaceous layer can be described as the forbs, grasses, and woody seedlings in the 0-2' zone in forest and nonforest cover types; with a coverage range greater than 75%. Wildlife species that utilize these dense herbaceous layer conditions; whether to forage, hide, or nest, are:

Wildlife Species	Habitat Breadth Category
Five-lined skink	Forest
Eastern garter snake	Forest-Krummholz-Nonforest-Water
Eastern ribbon snake	Forest-Nonforest-Water
Eastern smooth green snake	Forest-Krummholz-Nonforest
Green-winged teal	Nonforest
American black duck	Forest-Nonforest-Water
Northern pintail	Nonforest
Blue-winged teal	Nonforest
Northern shoveler	Nonforest
American wigeon	Nonforest-Water

SOME UPLAND GROUND VEGETATION USE

by age/size class



Wildlife Species (continued)	Habitat Breadth Category
Northern harrier	Nonforest
Northern goshawk	Forest-Nonforest
Rough-legged hawk	Nonforest
Gray partridge	Nonforest
Ring-necked pheasant	Nonforest
Ruffed grouse	Forest-Nonforest
Wild turkey	Forest-Nonforest
Spotted sandpiper	Nonforest-Water
Upland sandpiper	Nonforest
Short-eared owl	Nonforest
Red-headed woodpecker	Forest-Nonforest
Eastern kingbird	Forest-Nonforest
Purple martin	Forest-Nonforest-Water
Tree swallow	Forest-Nonforest-Water
Northern rough-winged swallow	Forest-Nonforest-Water
Bank swallow	Forest-Nonforest-Water
Cliff swallow	Forest-Nonforest
Barn swallow	Forest-Nonforest-Water
Eastern bluebird	Forest-Nonforest
Hermit thrush	Forest-Nonforest
Northern shrike	Forest-Nonforest
Loggerhead shrike	Forest-Nonforest
European starling	Forest-Nonforest
Blue-winged warbler	Forest-Nonforest
Golden-winged warbler	Forest-Nonforest
Tennessee warbler	Forest-Nonforest
Nashville warbler	Forest-Nonforest
Yellow warbler	Forest-Nonforest
Black-throated blue warbler	Forest
Prairie warbler	Forest-Nonforest
Palm warbler	Forest-Nonforest
Black-and-white warbler	Forest-Nonforest
Mourning warbler	Forest-Nonforest
Common yellowthroat	Forest-Nonforest
Hooded warbler	Forest-Nonforest
Northern cardinal	Forest-Nonforest-Water
Indigo bunting	Forest-Nonforest
Rufous-sided towhee	Forest-Nonforest
Field sparrow	Forest-Nonforest
Vesper sparrow	Nonforest
Savannah sparrow	Nonforest
Grasshopper sparrow	Nonforest
Henslow's sparrow	Nonforest
Song sparrow	Forest-Nonforest
White-throated sparrow	Forest-Krummholz-Nonforest
Dark-eyed junco	Forest-Krummholz-Nonforest
Lapland longspur	Nonforest
Snow bunting	Nonforest
Bobolink	Nonforest
Red-winged blackbird	Nonforest
Eastern meadowlark	Nonforest
Common grackle	Forest-Nonforest-Water

Wildlife Species (continued)	Habitat Breadth Category
Purple finch	Forest-Nonforest
Common redpoll	Forest-Nonforest
Hoary redpoll	Forest-Nonforest
American goldfinch	Forest-Nonforest
Water shrew	Forest-Nonforest-Water
Least shrew	Forest-Nonforest
Hairy-tailed mole	Forest-Nonforest
Eastern cottontail	Forest-Nonforest
European hare	Forest-Nonforest
Deer mouse	Forest-Krummholz-Nonforest
Meadow vole	Forest-Nonforest
Rock vole	Forest-Krummholz-Nonforest
Woodland vole	Forest-Nonforest
Southern bog lemming	Forest-Krummholz-Nonforest
Northern bog lemming	Forest-Krummholz-Nonforest
Meadow jumping mouse	Forest-Nonforest
Woodland jumping mouse	Forest-Nonforest
White-tailed deer	Forest-Nonforest

n = 80 species

Wildlife use of dense herbaceous lay conditions is highest in the regenerating age/seedling size class group (Figure M). Older age/larger size class groups are used less, due to the lack of dense herbaceous layer conditions associated with these groups.

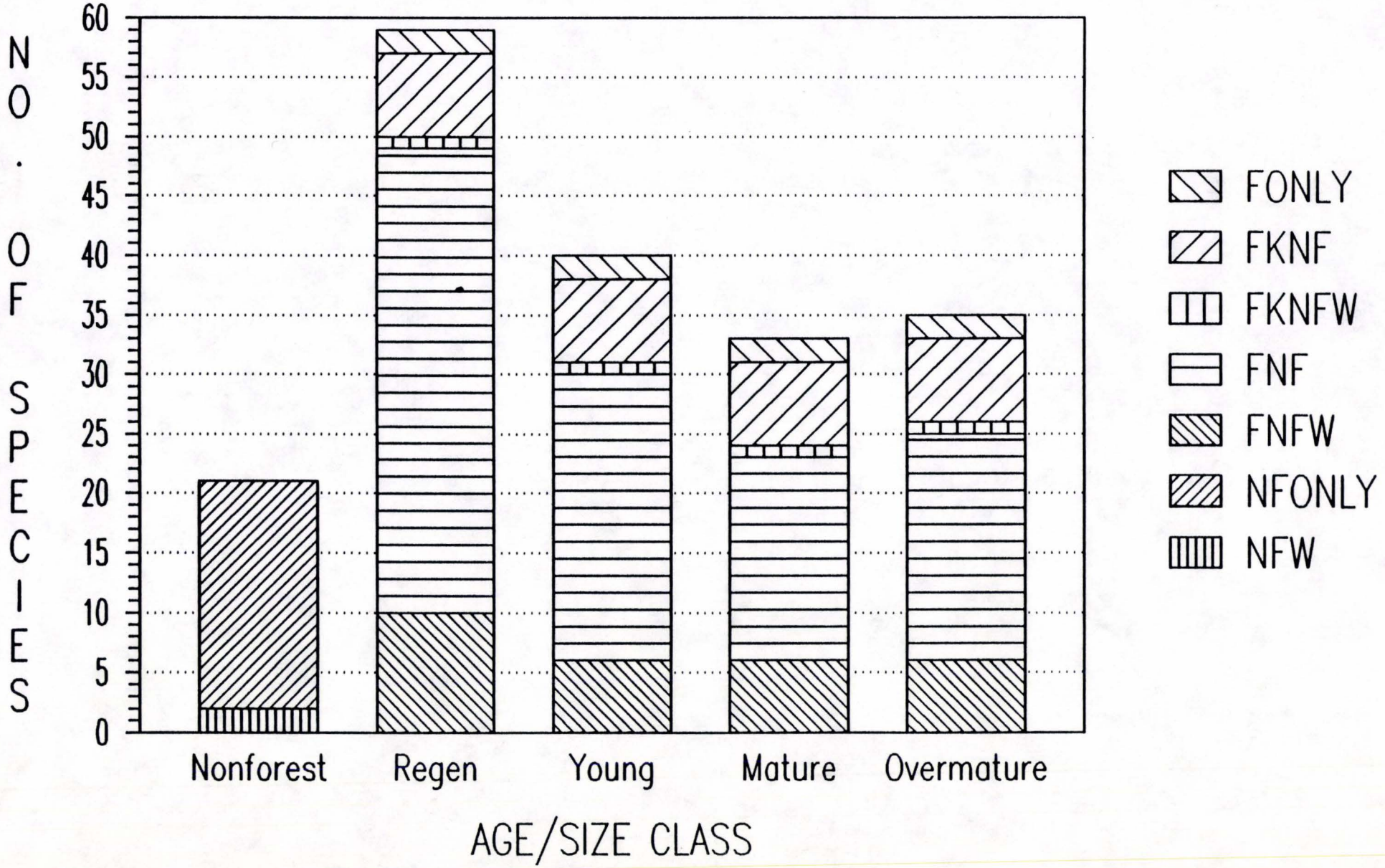
Wetland Herbaceous Coverage and Temporary Pools

Various sedges, cattails, sphagnum and other typical wetland plant species can be found in small and large inclusions of somewhat poorly to very poorly drained soils in closed drainages of upland landscapes. Earthmoving activities can rearrange drainage patterns to create opportunities for ponds and pools that remain full of water on a year round basis. Ephemeral pools of water can be found in the early spring due to the soil drainage type; these pools provide much egg-laying habitat for various woodland salamanders, frogs and toads that excessively drained soils can not provide. Wildlife species that utilize large and small wetland herbaceous ground vegetation situations include:

Figure ...

DENSE UPLAND GROUND VEGETATION USE

by age/size class



Wildlife Species	Habitat Breadth Category
Jefferson salamander	Forest-Nonforest
Northern two-lined salamander	Forest-Nonforest-Water
Eastern spadefoot	Forest-Nonforest
American toad	Forest-Nonforest-Water
Grey treefrog	Forest-Nonforest-Water
Bullfrog	Forest-Nonforest-Water
Green frog	Forest-Nonforest-Water
Mink frog	Forest-Nonforest-Water
Wood frog	Forest-Krummholz-Nonforest-Water
Northern leopard frog	Forest-Nonforest-Water
Bog turtle	Forest-Nonforest-Water
Eastern painted turtle	Forest-Nonforest-Water
Northern ribbon snake	Nonforest-Water
Timber rattlesnake	Forest-Nonforest-Water
Pied-billed grebe	Nonforest-Water
American bittern	Nonforest-Water
Great blue heron	Forest-Nonforest-Water
Green-backed heron	Forest-Nonforest-Water
Mute swan	Nonforest-Water
Canada goose	Nonforest-Water
American black duck	Forest-Nonforest-Water
Mallard	Nonforest-Water
Northern pintail	Nonforest
Blue-winged teal	Nonforest
Northern shoveler	Nonforest
Gadwall	Nonforest-Water
American wigeon	Nonforest-Water
Northern harrier	Nonforest
Sharp-shinned hawk	Forest-Nonforest
Black rail	Nonforest-Water
King rail	Nonforest
Virginia rail	Nonforest
Sora	Nonforest
Common moorhen	Nonforest-Water
American coot	Nonforest-Water
Spotted sandpiper	Nonforest-Water
American woodcock	Forest-Nonforest
Black tern	Nonforest-Water
Short-eared owl	Nonforest
Sedge wren	Nonforest
Marsh wren	Nonforest
Henslow's sparrow	Nonforest
Swamp sparrow	Forest-Nonforest
Red-winged blackbird	Nonforest
Common grackle	Forest-Nonforest-Water
Southern bog lemming	Forest-Krummholz-Nonforest
Northern bog lemming	Forest-Krummholz-Nonforest

n = 47 species

Wildlife use of wetland herbaceous cover conditions is highest (Figure N) in the wetland nonforest types and riparian (lakes, streams, and rivers) areas. Wildlife species that utilize nonforest cover types and water exclusively will not be found using small inclusions that many times are found in various forest cover types and age/size class groups. However, these small wetland inclusions and temporary pools provide habitat components for up to 21 forest dwelling species.

Waterside Decaying Logs

Waterside decaying logs are the dead and down logs that fall into the water in water influence landscapes/riparian areas. These structures provide basking locations for various amphibians and reptiles; loafing and nesting areas for ring-necked duck and river otter. Wildlife species that utilize these structural habitat features are:

Wildlife Species	Habitat Breadth Category
Northern leopard frog	Forest-Nonforest-Water
Stinkpot	Nonforest-Water
Map turtle	Nonforest-Water
Red-eared slider	Nonforest-Water
Plymouth redbelly turtle	Nonforest-Water
Eastern painted turtle	Forest-Nonforest-Water
Midland painted turtle	Nonforest-Water
Blanding's turtle	Nonforest-Water
Eastern spiny softshell	Water
Northern water snake	Forest-Nonforest-Water
Ring-necked duck	Nonforest-Water
River otter	Forest-Nonforest-Water

n = 13 species

Wildlife use of waterside decaying logs is highest in the wetland nonforest cover types and riparian (lake, stream, and river) areas (Figure O).

Figure N.

WETLAND GROUND VEGETATION USE

by age/size class

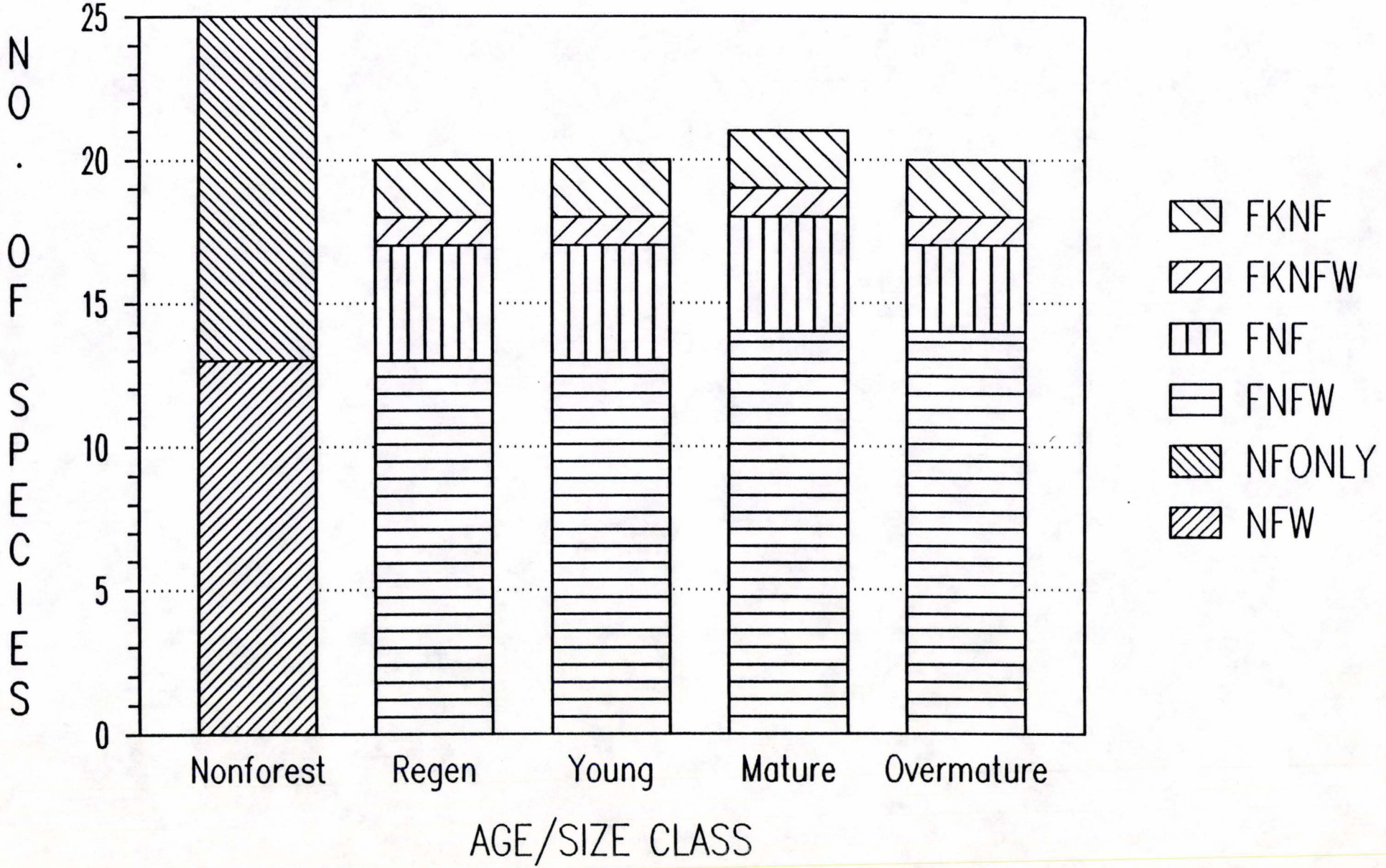
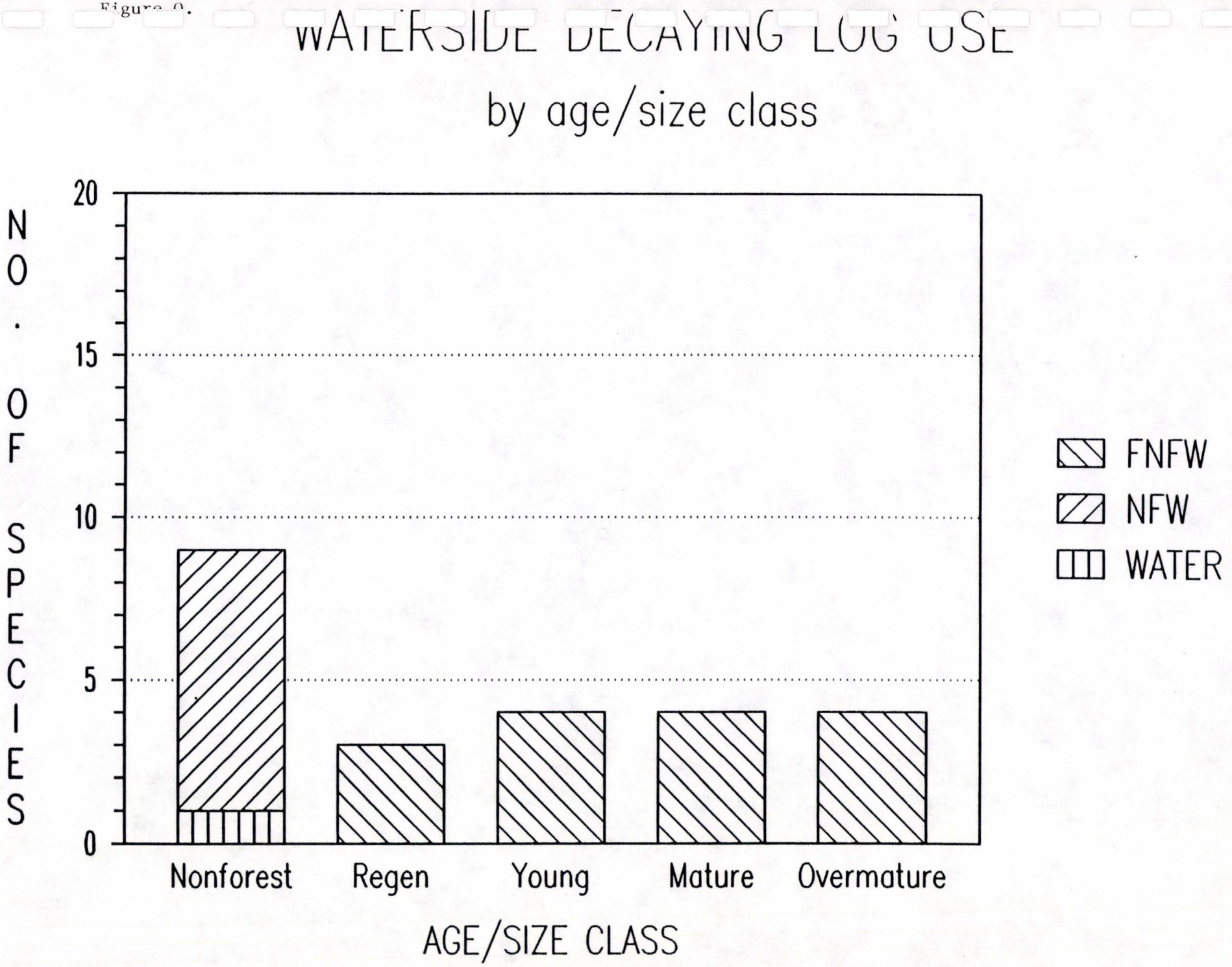


Figure 9.


WATERSIDE DECAYING LOG USE
by age/size class
NO. OF SPECIES
20
15
10
5
0
Nonforest
Regen
Young
Mature
Overmature
AGE/SIZE CLASS
FNFW
NFW
WATER

Wildlife use of forest cover types and age/size class groups is minimal; depending totally on the presence of permanent water within these stands.

Ground Surface Coverage

Rocky forest floors provide foraging and shelter sites for the following wildlife species:

Wildllife Species	Habitat Breadth Category
Northern spring salamander	Forest-Nonforest-Water
Northern two-lined salamander	Forest-Nonforest-Water
Black-and-white warbler	Forest-Nonforest
Worm-eating warbler	Forest
Common grackle	Forest-Nonforest-Water
Southern red-backed vole	Forest-Krummholz-Nonforest
Rock vole	Forest-Krummholz-Nonforest

n = 7 species

Dead and down woody material provides foraging and shelter sites for the following wildlife species:

Wildlife Species	Habitat Breadth Category
Marbled salamander	Forest-Nonforest-Water
Jefferson salamander	Forest-Nonforest
Silvery salamander	Forest-Nonforest
Blue-spotted salamander	Forest-Nonforest
Tremblay's salamander	Forest-Nonforest
Spotted salamander	Forest-Nonforest-Water
Red-spotted newt	Forest-Krummholz-Nonforest-Water
Mountain dusky salamander	Forest-Water
Redback salamander	Forest-Nonforest
Slimy salamander	Forest-Nonforest
Four-toed salamander	Forest-Nonforest-Water
Grey treefrog	Forest-Nonforest-Water
Eastern box turtle	Forest-Nonforest-Water
Five-lined skink	Forest
Eastern hognose snake	Forest-Nonforest
Northern ringneck snake	Forest-Nonforest
Eastern worm snake	Forest-Nonforest
Northern black racer	Forest-Nonforest

Wildlife Species (continued)	Habitat Breadth Category
Black rat snake	Forest-Krummholz-Nonforest
Northern copperhead	Forest-Krummholz-Nonforest-Water
Ruffed grouse	Forest-Nonforest
Yellow-bellied flycatcher	Forest-Nonforest
Winter wren	Forest-Nonforest
Black-and-white warbler	Forest-Nonforest
Worm-eating warbler	Forest
Northern waterthrush	Forest-Nonforest-Water
Louisiana waterthrush	Forest-Nonforest
Canada warbler	Forest-Nonforest
Virginia opossum	Forest-Nonforest
Masked shrew	Forest-Krummholz-Nonforest
Smokey shrew	Forest-Nonforest
Long-tailed shrew	Forest-Krummholz
Pygmy shrew	Forest-Krummholz-Nonforest
Eastern chipmunk	Forest-Krummholz-Nonforest
White-footed mouse	Forest-Krummholz-Nonforest
S. red-backed vole	Forest-Krummholz-Nonforest
Gray fox	Forest-Nonforest
Black bear	Forest-Nonforest-Water
Marten	Forest-Krummholz
Fisher	Forest-Krummholz-Nonforest
Ermine	Forest-Nonforest
Long-tailed weasel	Forest-Nonforest
Mink	Forest-Nonforest-Water
Striped skunk	Forest-Nonforest
Lynx	Forest-Krummholz-Nonforest
Bobcat	Forest-Krummholz-Nonforest

n = 46 species

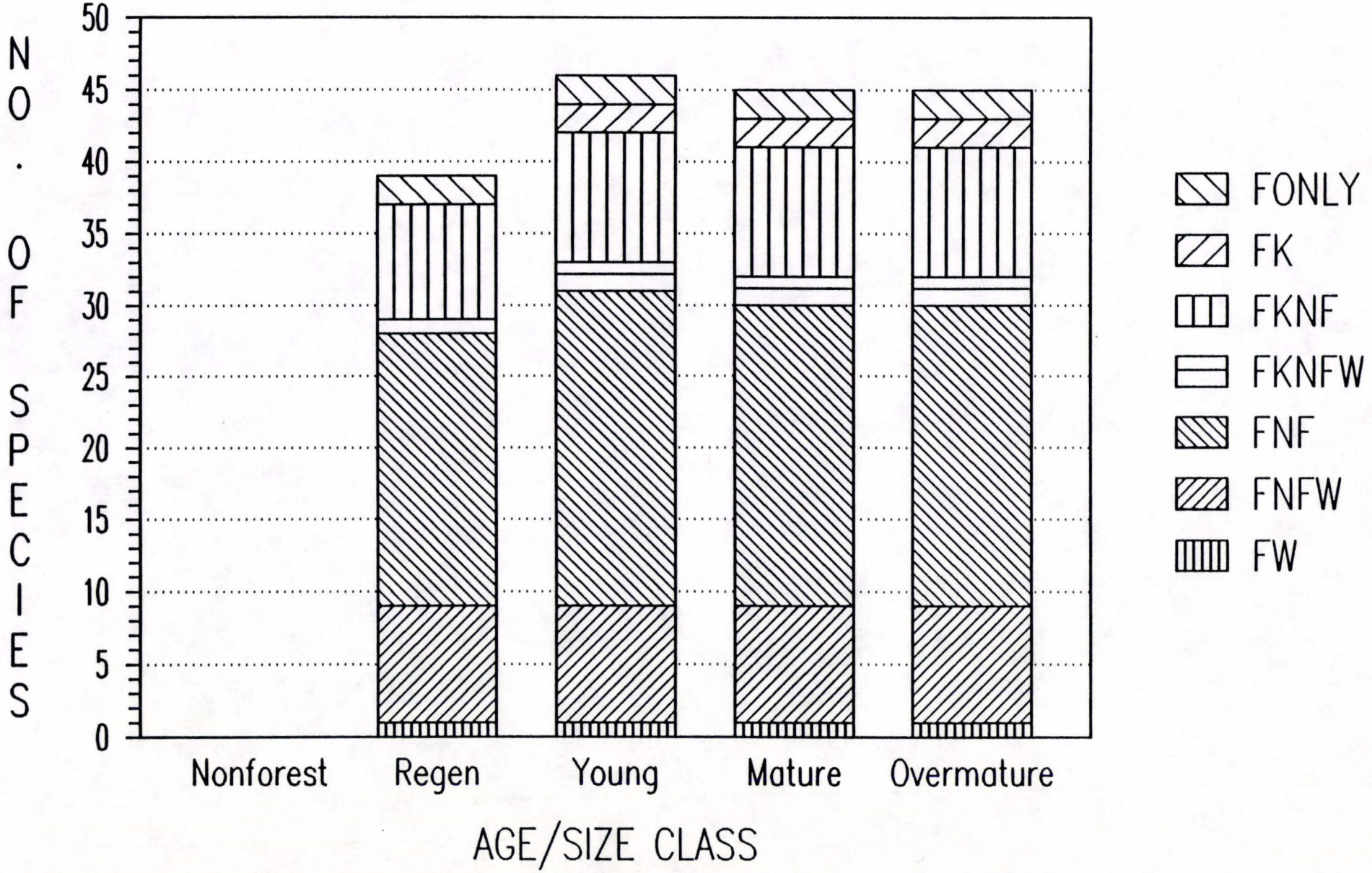
Wildlife use of dead and down woody material is similar throughout the older age/size class groups; while use of regenerating age/seedling size class group is slightly less (Figure P).

Forest litter, duff, and mossy ground surfaces provide foraging and shelter sites for the following wildlife species:

gu .

DEAD AND DOWN MATERIAL USE

by age/size class



Wildllife Species	Habitat Breadth Category
Jefferson salamander	Forest-Nonforest
Silvery salamander	Forest-Nonforest
Blue-spotted salamander	Forest-Nonforest
Tremblay's salamander	Forest-Nonforest
Red-spotted newt	Forest-Krummholz-Nonforest-Water
Northern dusky salamander	Forest-Krummholz-Nonforest-Water
Four-toed salamander	Forest-Nonforest-Water
Northern two-lined salamander	Forest-Nonforest-Water
Eastern spadefoot	Forest-Nonforest
Wood frog	Forest-Krummholz-Nonforest-Water
Northern redbelly snake	Forest-Krummholz-Nonforest
E. hognose snake	Forest-Nonforest
Spruce grouse	Forest-Krummholz-Nonforest
Tennessee warbler	Forest-Nonforest
Nashville warbler	Forest-Nonforest
Black-and-white warbler	Forest-Nonforest
Worm-eating warbler	Forest
Ovenbird	Forest
Northern waterthrush	Forest-Nonforest-Water
Louisiana waterthrush	Forest-Nonforest
Wilson's warbler	Forest-Nonforest
Canada warbler	Forest-Nonforest
Rufous-sided towhee	Forest-Nonforest
Masked shrew	Forest-Krummholz-Nonforest
Smokey shrew	Forest-Nonforest
Pygmy shrew	Forest-Krummholz-Nonforest
Short-tailed shrew	Forest-Krummholz-Nonforest
Woodland vole	Forest-Nonforest
Southern bog lemming	Forest-Krummholz-Nonforest
Northern bog lemming	Forest-Krummholz-Nonforest

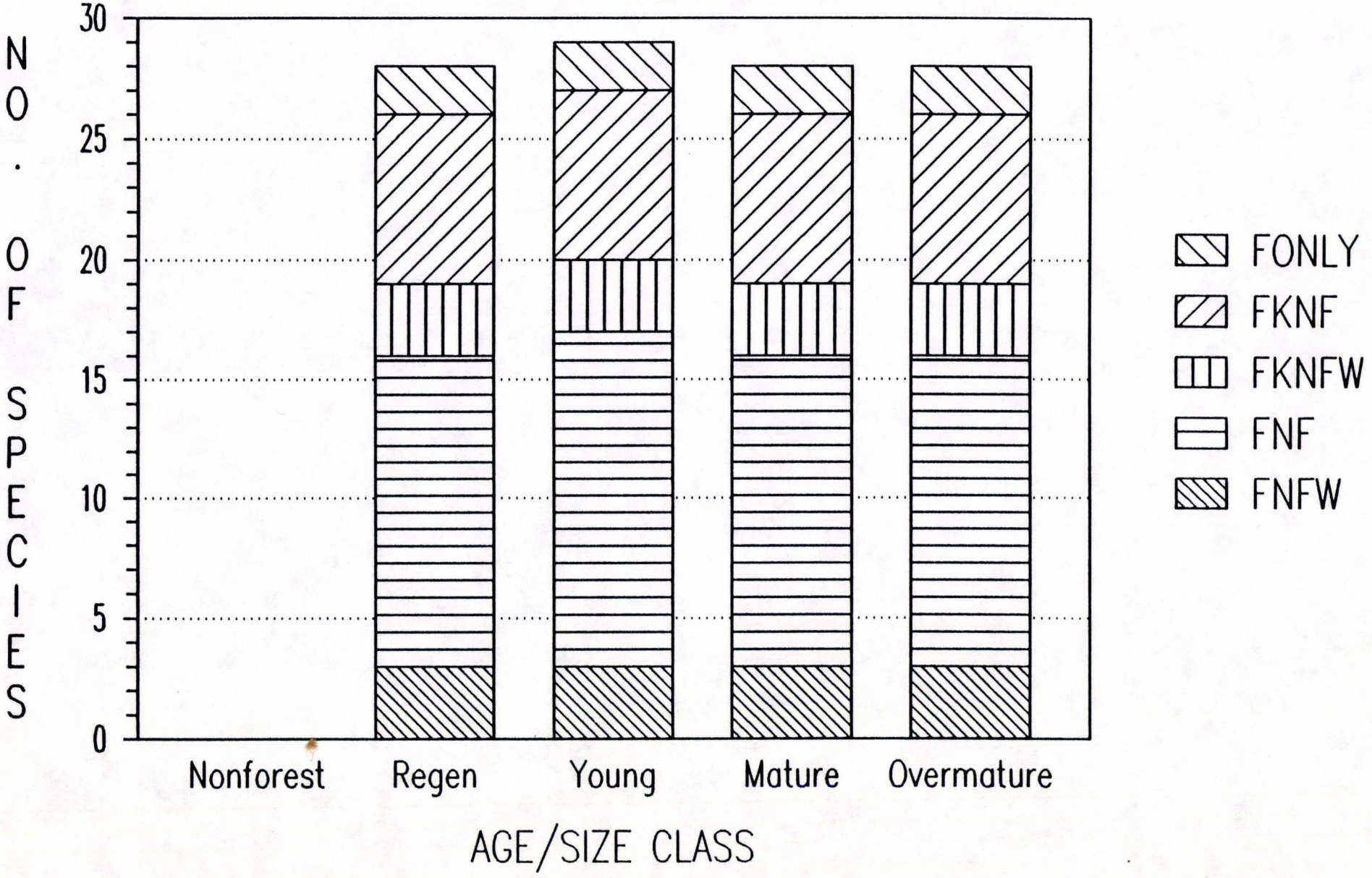
n = 30 species

Wildlife use of forest litter, duff and mossy ground surfaces remains constant throughout the forest cover types and age/size class groups and wetland nonforest cover types; while use is lower in upland nonforest types, krummholz, and water (Figure Q).

Figure 4.

LITTER USE

by age/size class



Subterranean Habitats

Wildlife species with fossorial (underground burrowing) habits abound, in both moist and well-drained forested and nonforested environments. The mole salamanders utilize moist conditions found under rotten logs and in somewhat poorly drained soils; Eastern spadefoot and Fowler's toad prefers sandy well-drained soils in which to burrow. Muddy streambanks and shorelines are ideal burrowing sites for turtles, and muskrats. Rocky crevices, boulder piles, and talus slopes, especially near water are ideal hibernacula for black racers, black rat snake, northern copperhead, and timber rattlesnake. Dry sand and gravel banks are excellent nesting sites for belted kingfisher, northern rough-winged swallows, and bank swallows. Open nonforested areas on sandy loams like grassy openings, abandoned fields, and pastures are ideal burrowing spots for hairy-tailed and eastern moles, woodchuck, meadow and woodland voles. Forest dwelling fossorial mammals include southern red-backed vole, northern and southern bog lemmings, and woodland jumping mouse. These examples demonstrate a range of fossorial habitats (Figure R) for the following wildlife species:

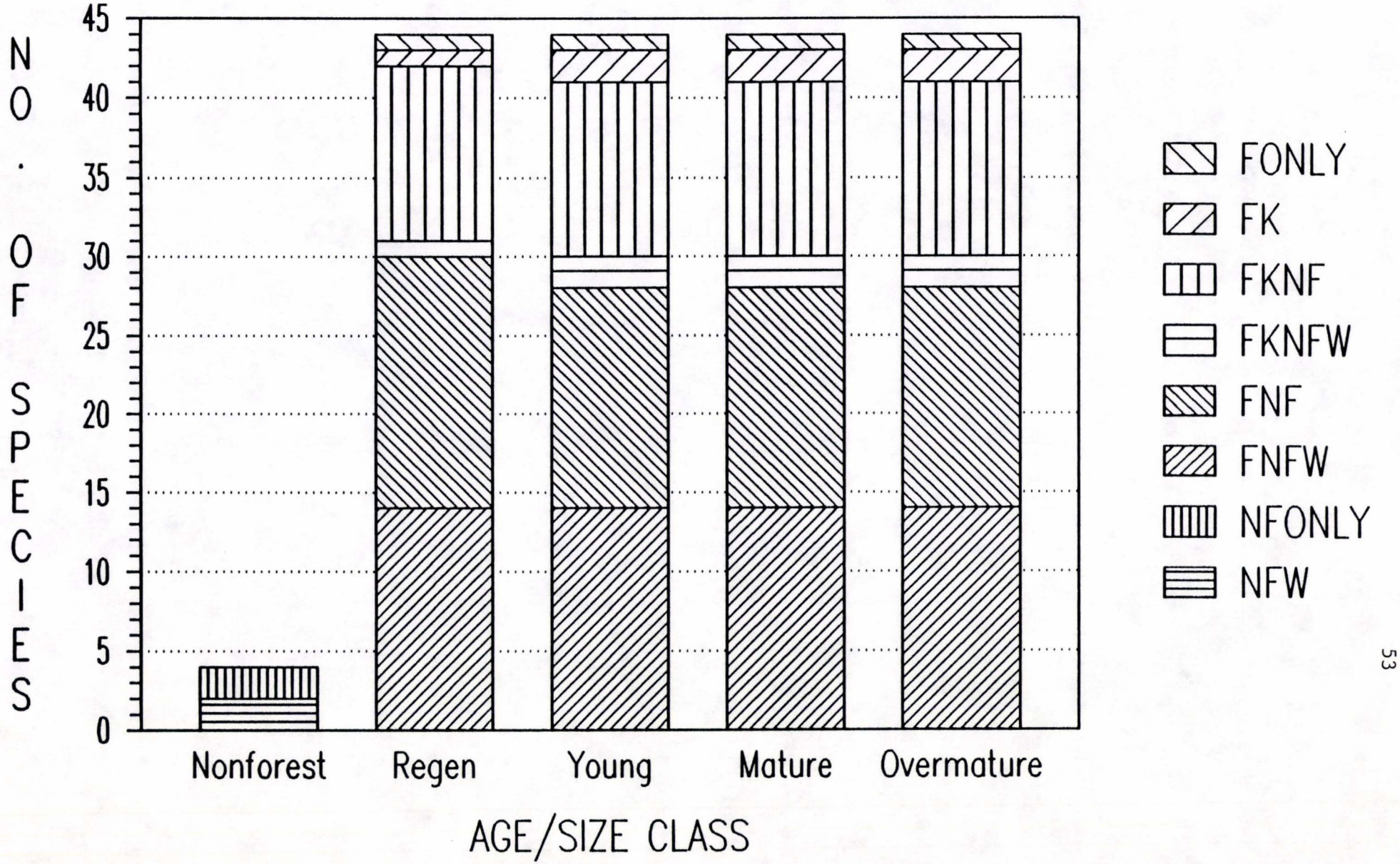
Wildlife Species	Habitat Breadth Category
Marbled salamander	Forest-Nonforest-Water
Spotted salamandere	Forest-Nonforest-Water
Northern dusky salamander	Forest-Krummholz-Nonforest-Water
Redback salamander	Forest-Nonforest
Slimy salamander	Forest-Nonforest
Northern spring salamander	Forest-Nonforest-Water
Eastern spadefoot	Forest-Nonforest
American toad	Forest-Nonforest-Water
Fowler's toad	Forest-Nonforest-Water
Northern spring peeper	Forest-Nonforest-Water
Green frog	Forest-Nonforest-Water

Wildlife Species (continued)	Habitat Breadth Category
Bog turtle	Forest-Nonforest-Water
Wood turtle	Forest-Nonforest-Water
Eastern box turtle	Forest-Nonforest-Water
Five-lined skink	Forest
Northern brown snake	Forest-Nonforest
Northern redbelly snake	Forest-Krummholz-Nonforest
Eastern ribbon snake	Forest-Nonforest-Water
Northern ringneck snake	Forest-Nonforest
Eastern worm snake	Forest-Nonforest
Northern black racer	Forest-Nonforest
Black rat snake	Forest-Krummholz-Water
Northern copperhead	Forest-Krummholz-Nonforest-Water
Timber rattlesnake	Forest-Nonforest-Water
Belted kingfisher	Nonforest-Water
Northern rough-winged swallow	Forest-Nonforest-Water
Bank swallow	Forest-Nonforest-Water
Long-tailed shrew	Forest-Krummholz
Short-tailed shrew	Forest-Krummholz-Nonforest
Least shrew	Forest-Nonforest
Hairy-tailed mole	Forest-Nonforest
Eastern mole	Forest-Nonforest
Star-nosed mole	Forest-Nonforest-Water
Eastern cottontail	Forest-Nonforest
European hare	Forest-Nonforest
Eastern chipmunk	Forest-Krummholz-Nonforest
Woodchuck	Forest-Nonforest
Red squirrel	Forest-Krummholz
Beaver	Forest-Nonforest-Water
Deer mouse	Forest-Krummholz-Nonforest
Southern red-backed vole	Forest-Krummholz-Nonforest
Woodland vole	Forest-Nonforest
Muskrat	Nonforest-Water
Norway rat	Nonforest
House mouse	Nonforest
Southern bog lemming	Forest-Krummholz-Nonforest
Northern bog lemming	Forest-Krummholz-Nonforest
Meadow jumping mouse	Forest-Nonforest
Woodland jumping mouse	Forest-Nonforest
Porcupine	Forest-Krummholz-Nonforest
Coyote	Forest-Krummholz-Nonforest
Red fox	Forest-Krummholz-Nonforest
Ermine	Forest-Nonforest
Long-tailed weasel	Forest-Nonforest
Mink	Forest-Nonforest-Water
Striped skunk	Forest-Nonforest

n = 56 species

SUBTERRANEAN USE

by age/size class



Seeps

Seeps occur across the New England landscape on lower slopes of glacial till hills and bedrock. The usually lush ground vegetation associated with seeps and the moist cool environment provides feeding and shelter sites for wildlife species like:

Wildlife Species	Habitat Breadth Category
Northern dusky salamander	Forest-Krummholz-Nonforest-Water
Mountain dusky salamander	Forest-Water
Northern spring salamander	Forest-Nonforest-Water
Northern two-lined salamander	Forest-Nonforest-Water
Green frog	Forest-Nonforest-Water
Wild turkey	Forest-Nonforest-Water
Southern red-backed vole	Forest-Krummholz-Nonforest

n = 7 species

Gravel Pits and Bare Ground

Gravel pits and patches of well-drained bare ground can be found most anywhere there has been some human use of upland landscapes. Roadside edges, log decking areas, and recently plowed and bare fields are examples of similar habitat conditions where there is sparse ground vegetation; lots of available grit, waste grass and forb seeds, and populations of flying and ground dwelling insects. These types of habitat conditions are favorable for the following wildlife species:

Wildlife Species	Habitat Breadth Category
Killdeer	Nonforest
Common nighthawk	Forest-Nonforest
Horned lark	Forest-Nonforest
Chipping sparrow	Forest-Nonforest
Lapland longspur	Nonforest
Snow bunting	Nonforest
House finch	Forest-Nonforest

n = 7 species

Slashpiles

Slashpiles usually result either from land clearing or silvicultural activities. Piling brush, slash or other logging residual in loose rows or piles creates denning, hiding and other shelter areas for different types of wildlife species. Newts and salamanders find moist cool temperatures and a steady food source under rotting logs and other residual at the bottom of the piles. Snakes find protection and hunt in these piles for frogs and rodents. Smaller mammals like cottontail rabbits, foxes, and coyotes can den successfully in these types of piles. These slashpiles can become more attractive to larger mammals like bear when in addition to providing cover, the berry canes that eventually cover these piles begin to bear fruit. The wildlife species that utilize slashpiles are:

Wildlife Species	Habitat Breadth Category
Red-spotted newt	Forest-Krummholz-Nonforest-Water
Redback salamander	Forest-Nonforest
Wood frog	Forest-Krummholz-Nonforest-Water
Eastern box turtle	Forest-Nonforest-Water
Northern brown snake	Forest-Nonforest
Northern ringneck snake	Forest-Nonforest
Northern black racer	Forest-Nonforest
House wren	Forest-Nonforest
Virginia opossum	Forest-Nonforest
Eastern cottontail	Forest-Nonforest
New England cottontail	Forest-Nonforest
Southern red-backed vole	Forest-Krummholz-Nonforest
Black bear	Forest-Nonforest-Water
Ermine	Forest-Nonforest

n = 14 species

Slashpiles most often are found in regenerating age/seedling size class stands or stands where some type of intermediate treatment has recently been completed. Piles of woody debris can provide hiding cover and denning sites for amphibians, reptiles, small mammals, and depending on size, even several of the larger mammals like bear; regardless of age/size class of the surrounding stand.

Junkpiles

Junkpiles tell much about the recent past across northern New England's landscapes. The wreckage of collapsed wooden houses, sheds and buildings stand as quiet testimony to a time in New England where open fields, pastures, and cultivated land spread over the landscape; when woodlots were as rare as grassy openings are in today's forested landscapes. These piles of old building materials, equipment, household and farming refuse; combined with some mixture of forested and nonforested cover types and water provide excellent sheltering sites for the following wildlife species, many of which are insect and rodent predators:

Wildlife Species	Habitat Breadth Category
Wood frog	Forest-Krummholz-Nonforest-Water
Five-lined skink	Forest
Northern water snake	Forest-Nonforest-Water
Northern brown snake	Forest-Krummholz-Nonforest
Northern redbelly snake	Forest-Krummholz-Nonforest
Eastern garter snake	Forest-Krummholz-Nonforest-Water
Eastern hognose snake	Forest-Nonforest
Northern ringneck snake	Forest-Nonforest
Northern black racer	Forest-Nonforest
Black rat snake	Forest-Krummholz-Nonforest

Wildlife Species (continued)	Habitat Breadth Category
Eastern milk snake	Forest-Krummholz-Nonforest-Water
House wren	Forest-Nonforest
Virginia opossum	Forest-Nonforest
Eastern cottontail	Forest-Nonforest

n = 14 species

Mast and Fruit

Hard mast refers to the nut producing tree and shrub species of New England; specifically the walnuts, butternuts, hickories, oak, beech, and hazel. Soft mast includes the winged seed producing tree species; specifically birch, maple, hophornbeam, pine, spruce, fir, and hemlock; and are not considered in this discussion directly. Fleshy fruits include the mountain ash, various Vaccinium and Rubus sp. berries and wild strawberry. Hard mast provides a variable but high caloric source of digestible lipids and carbohydrates needed by most wildlife species that either overwinter in severe weather areas or migrate to more moderate weather areas for the winter. A predictable seasonal and long-term availability of hard mast and fleshy fruits increases the foraging success and survivability of wildlife species like:

Wildlife Species	Habitat Breadth Category
Wood duck	Forest-Nonforest-Water
American black duck	Forest-Nonforest-Water
Mallard	Nonforest-Water
Ruffed grouse	Forest-Nonforest
Wild turkey	Forest-Nonforest
Red-headed woodpecker	Forest-Nonforest
Red-bellied woodpecker	Forest-Nonforest
Hairy woodpecker	Forest-Nonforest
Blue jay	Forest-Nonforest
American crow	Forest-Nonforest
Common raven	Forest-Krummholz-Nonforest-Water
Black-capped chickadee	Forest-Krummholz-Nonforest
Tufted titmouse	Forest-Nonforest
White-breasted nuthatch	Forest-Nonforest

Wildlife Species (continued)	Habitat Breadth Category
Brown creeper	Forest-Nonforest
Northern mockingbird	Forest-Nonforest
Brown thrasher	Forest-Nonforest
Bohemian waxwing	Forest-Nonforest
Cedar waxwing	Forest-Nonforest
Rufous-sided towhee	Forest-Nonforest
Common grackle	Forest-Nonforest-Water
Virginia opossum	Forest-Nonforest
Eastern chipmunk	Forest-Krummholz-Nonforest
Gray squirrel	Forest
Red squirrel	Forest-Krummholz
Southern flying squirrel	Forest-Nonforest
Northern flying squirrel	Forest
Deer mouse	Forest-Krummholz-Nonforest
White-footed mouse	Forest-Krummholz-Nonforest
Southern red-backed vole	Forest-Krummholz-Nonforest
Woodland vole	Forest-Nonforest
Meadow jumping mouse	Forest-Nonforest
Porcupine	Forest-Krummholz-Nonforest
Coyote	Forest-Krummholz-Nonforest
Red fox	Forest-Krummholz-Nonforest
Gray fox	Forest-Nonforest
Black bear	Forest-Nonforest-Water
Raccoon	Forest-Nonforest
Striped skunk	Forest-Nonforest
White-tailed deer	Forest-Nonforest

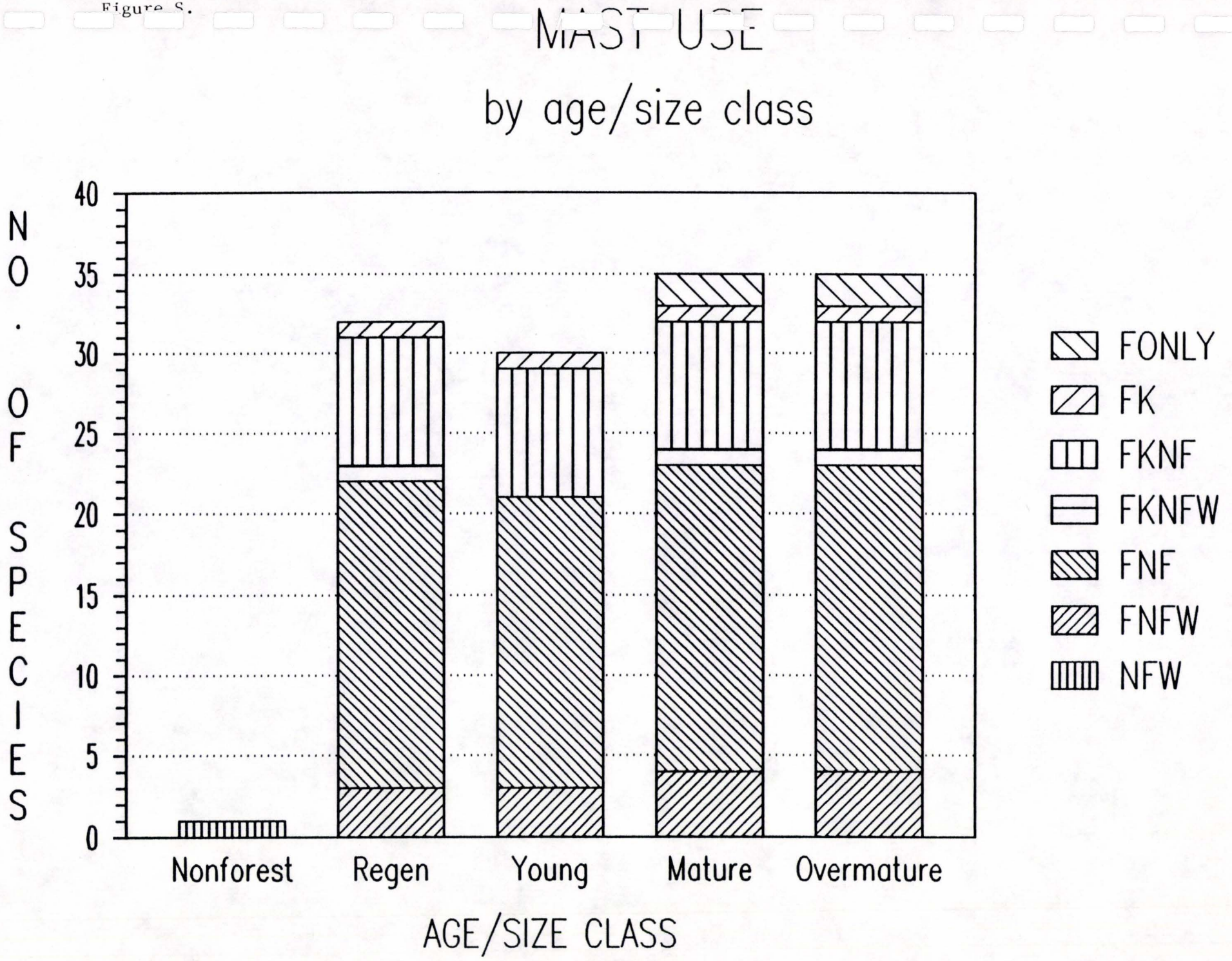
n = 40 species

Wildlife use of hard mast and fleshy fruits is consistent throughout the upland nonforest and forest cover types and age/size class groups; perhaps due to the sometimes scattered nature of mast trees throughout upland openings and forest stands of all age/size classes (Figure S).

Woods Roads

Large yellow birches in forested stands along woods roads provide excellent nesting sites for broad-winged hawks, who forage in forested and upland nonforested cover types nearby these types of nest trees.

Figure 5.


MAST USE
by age/size class
NO. OF SPECIES
40
35
30
25
20
15
10
5
0
Nonforest
Regen
Young
Mature
Overmature
AGE/SIZE CLASS
FONLY
FK
FKNF
FKNFW
FNF
FNFW
NFW

No Special Requirements

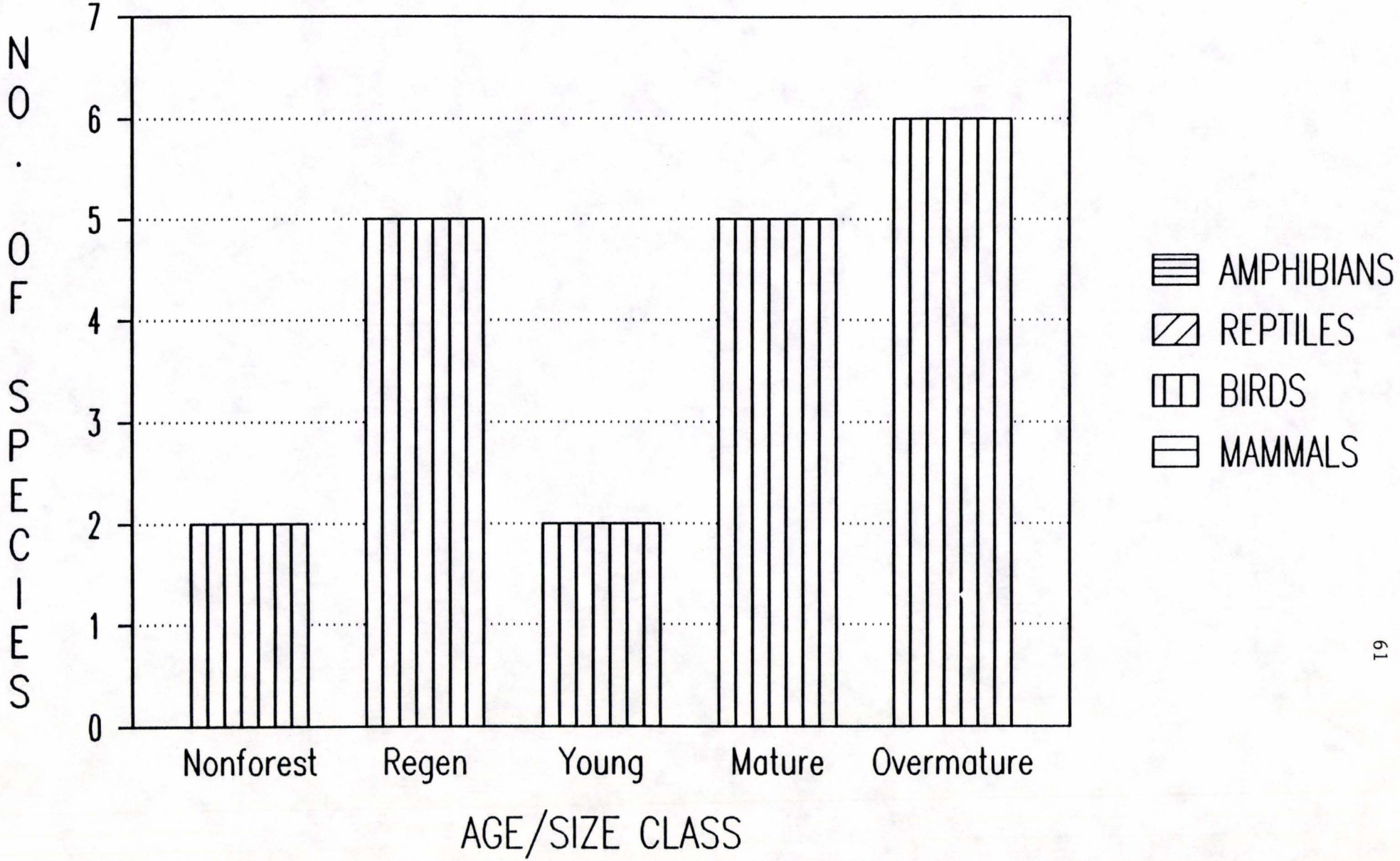
There are six wildlife species in this database that just do not fit this terrestrial habitat configuration, mostly due to either requiring totally freshwater habitat components or spending a high percentage of time in estuarine habitats. These species like the bufflehead, are winter visitors to New England's estuarine habitats and open rivers and lakes. Open landfills have contributed to the inland distribution of several gull species like the ring-billed gull and herring gull. Great black-backed gull and fish crow are inhabitants of estuarine habitats. Mudpuppy is entirely aquatic in its habitat requirements.

Wildlire Species	Habitat Breadth Category
Mudpuppy	Nonforest-Water
Bufflehead	Water
Ring-billed gull	Nonforest-Water
Herring gull	Water
Great black-backed gull	Water
Fish crow	Water

n = 6 species

HIGH EXPOSED PERCH USE

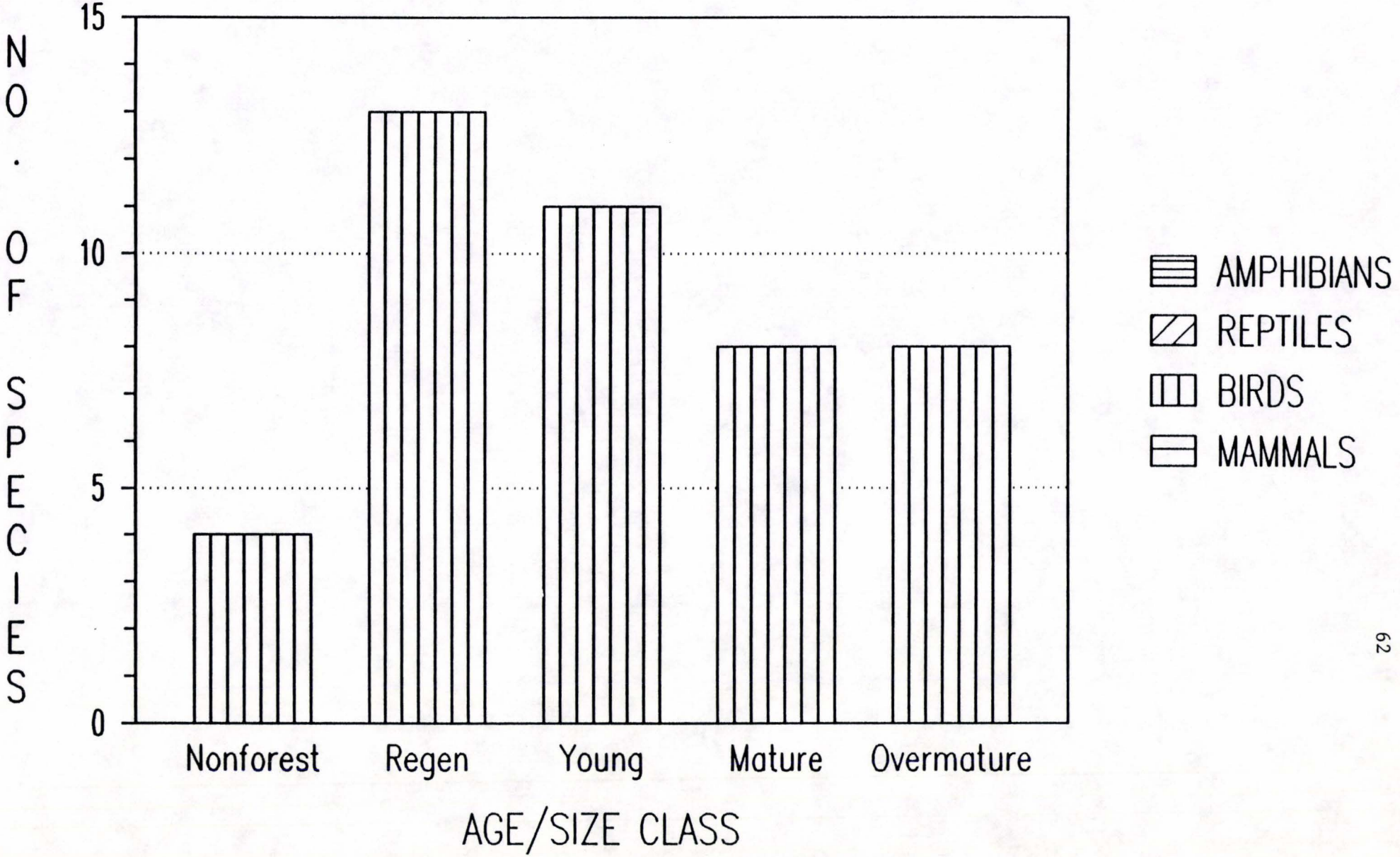
Taxonomic Comparisons by Age/Size Class



Appendix A-2.

LOW EXPOSED PERCH USE

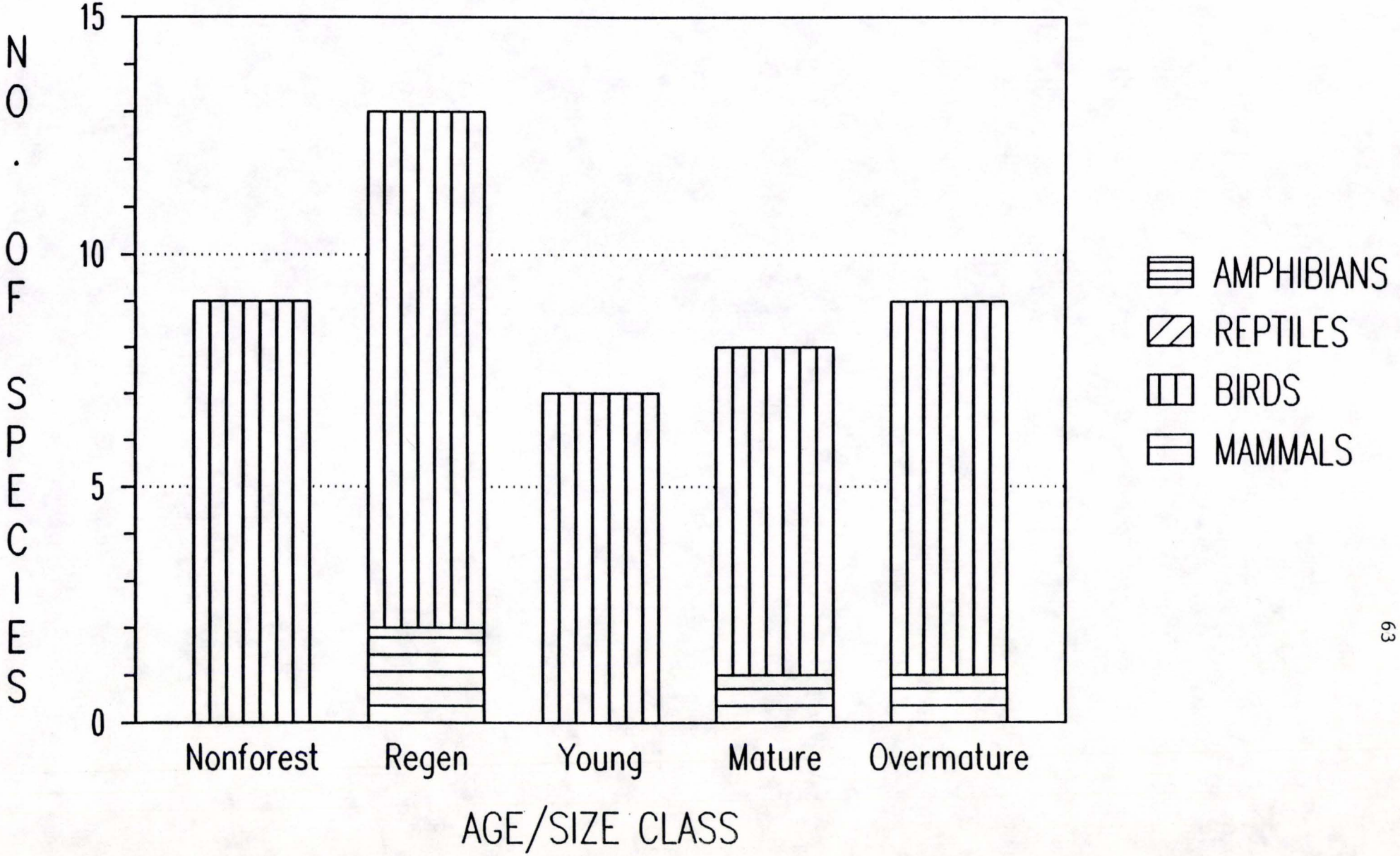
Taxonomic Comparisons by Age/Size Class



Appendix A-3.

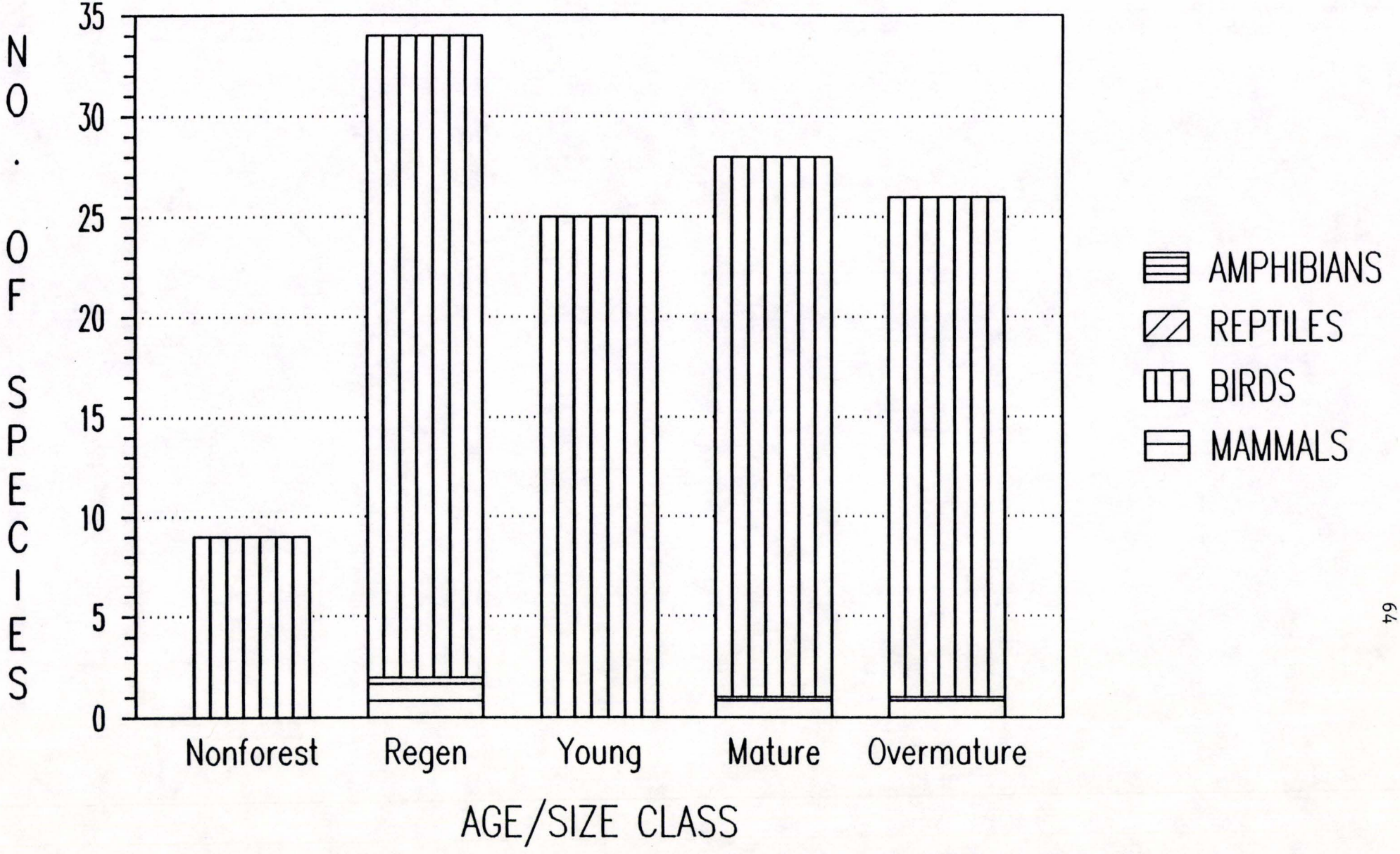
MINIMAL CANOPY USE

Taxonomic Comparisons by Age/Size Class



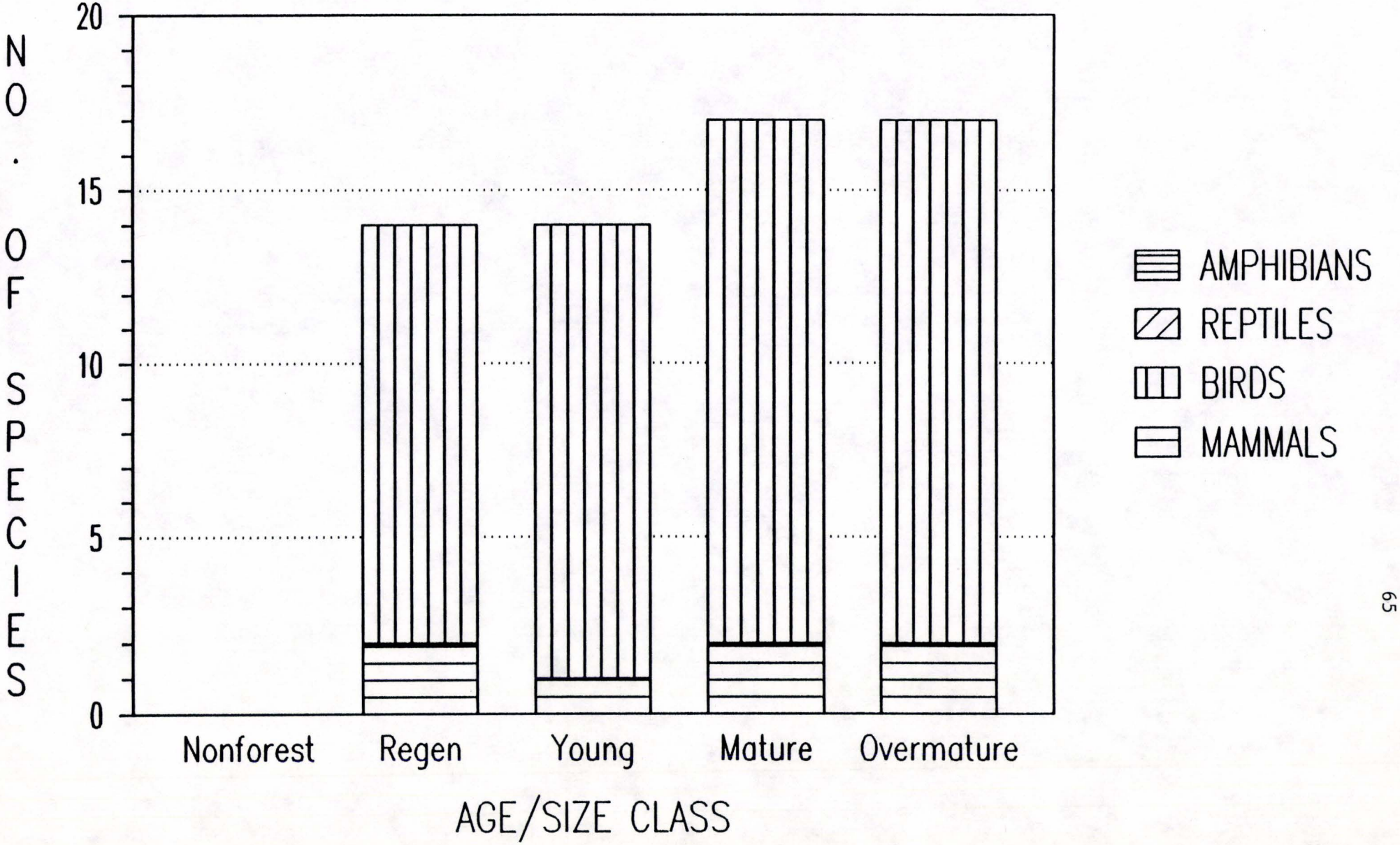
OPEN CANOPY USE

Taxonomic Comparisons by Age/Size Class



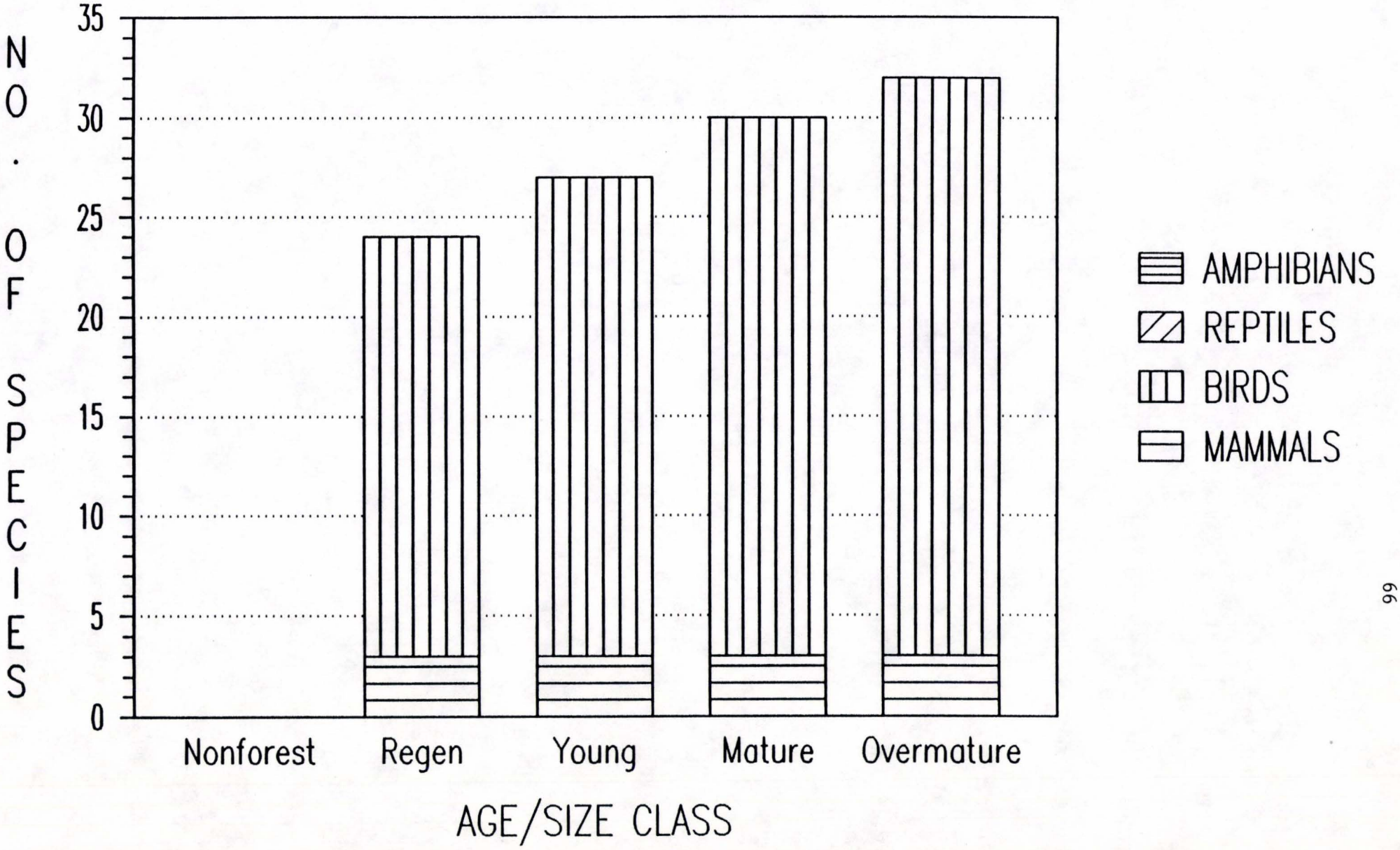
PARTIAL CANOPY USE

Taxonomic Comparisons by Age/Size Class



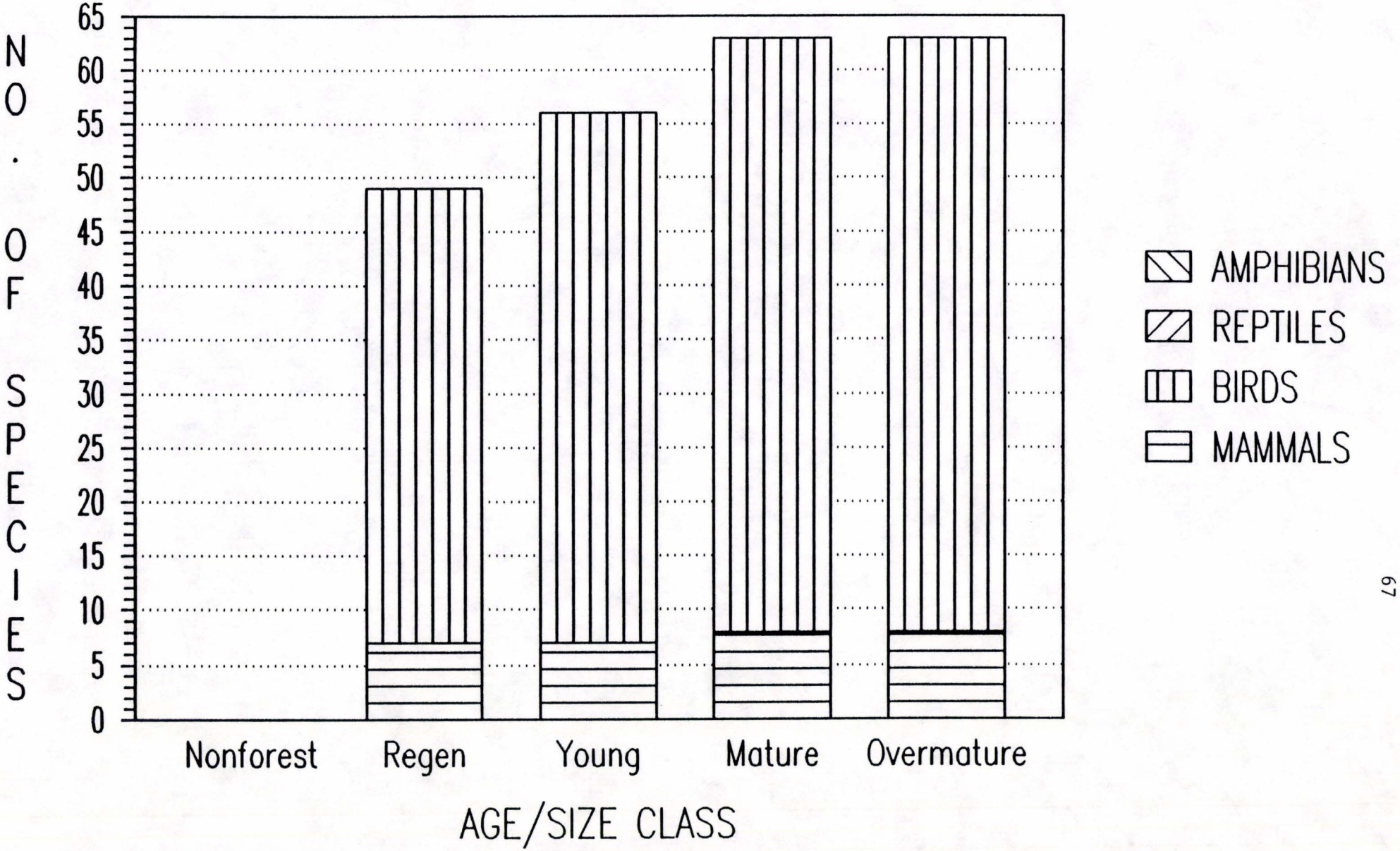
CLOSED CANOPY USE

Taxonomic Comparisons by Age/Size Class



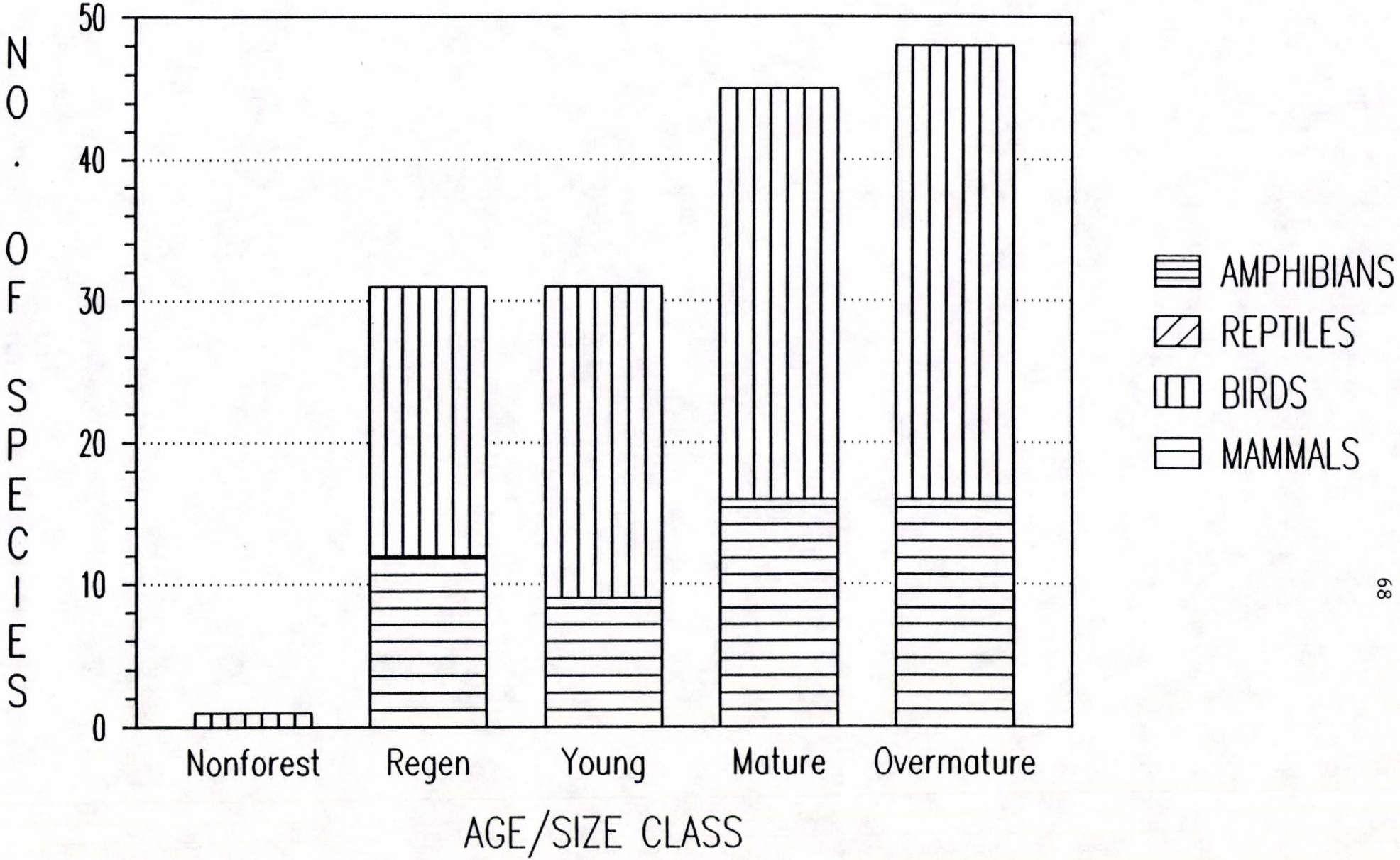
OVERSTORY INCLUSION USE

Taxonomic Comparisons by Age/Size Class



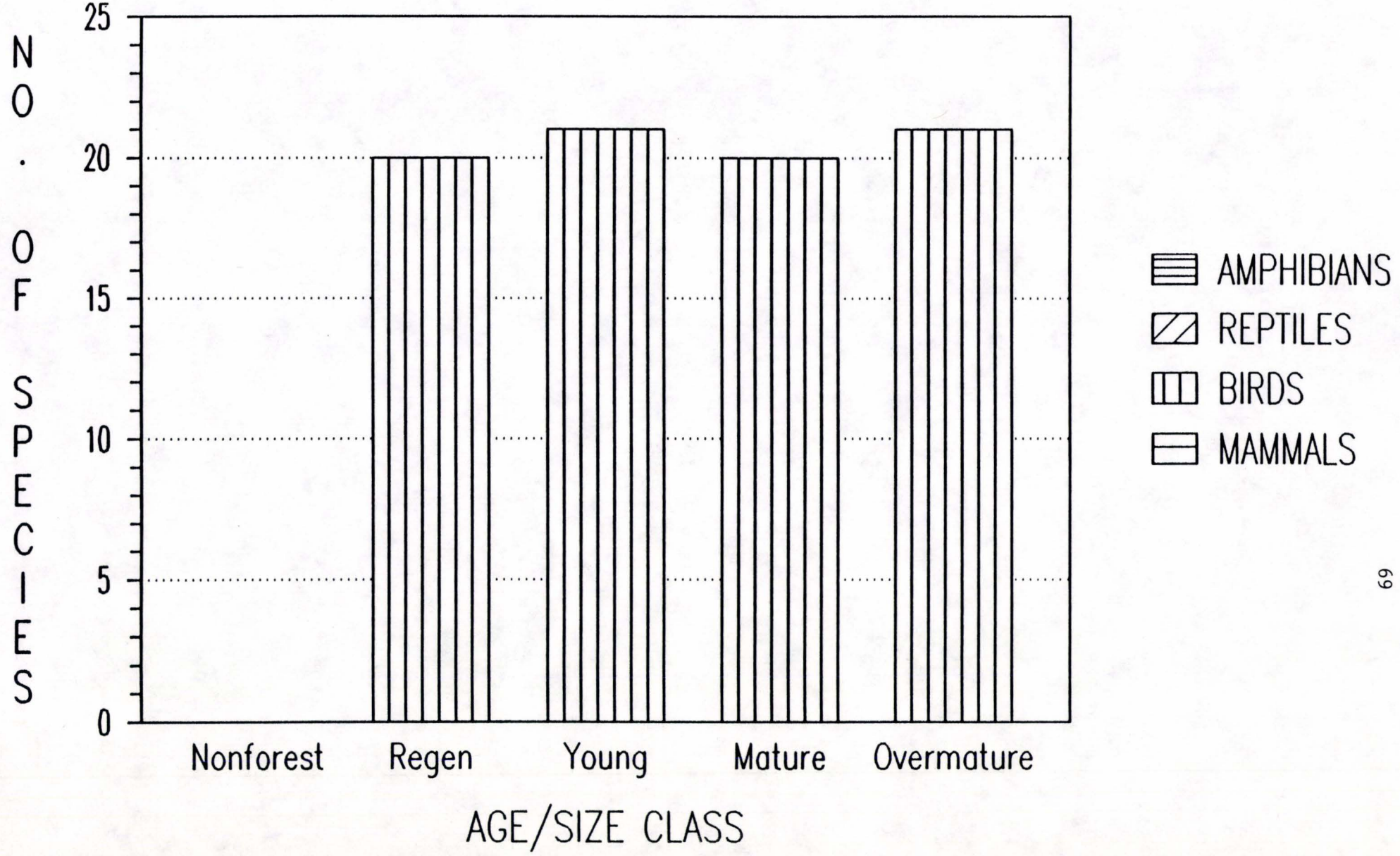
TREE BOLE USE

Taxonomic Comparisons by Age/Size Classes



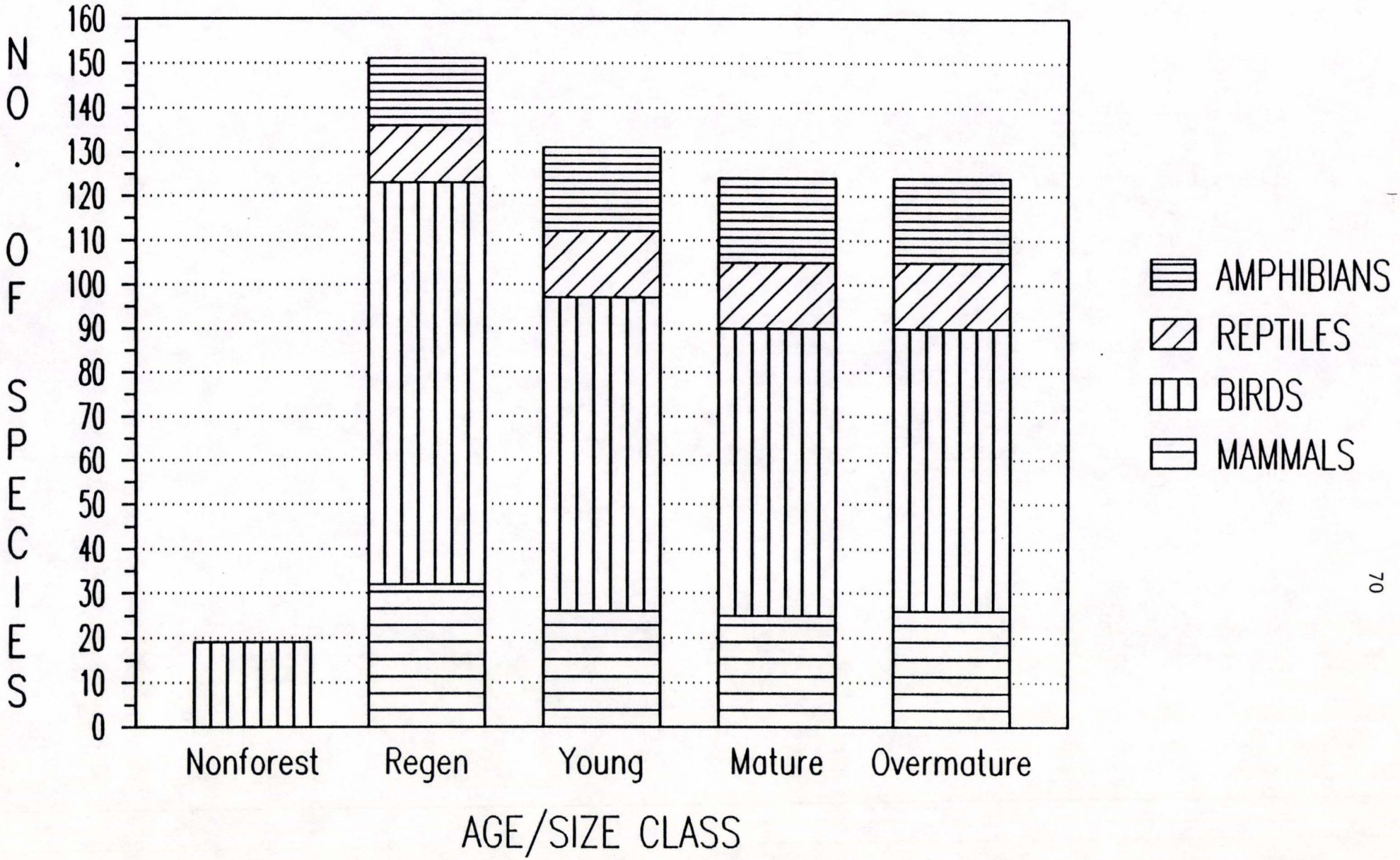
MIDSTORY LAYER USE

Taxonomic Comparisons by Age/Size Class



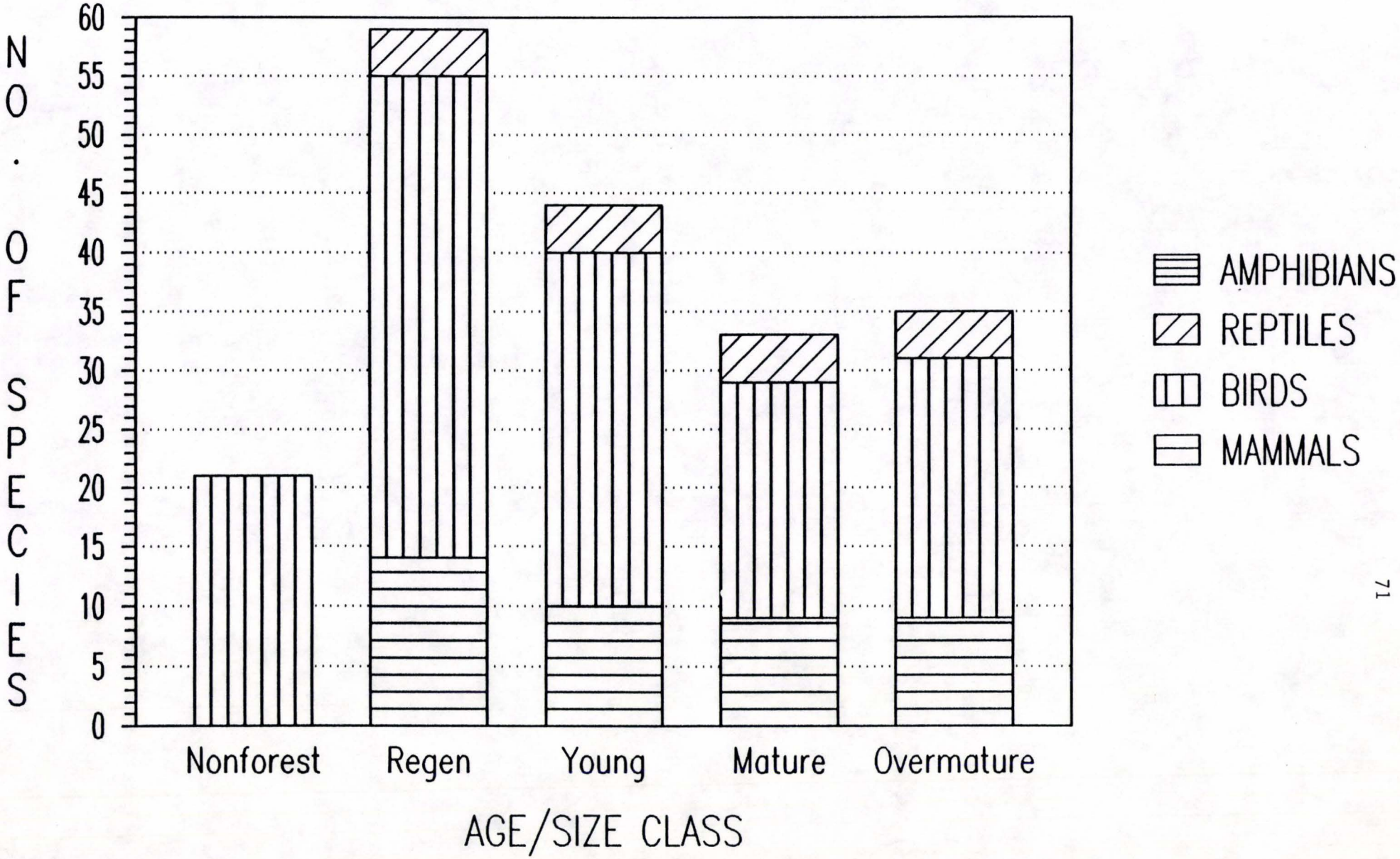
SHRUB LAYER USE

Taxonomic Comparisons by Age/Size Class



DENSE UPLAND GROUND VEGETATION USE

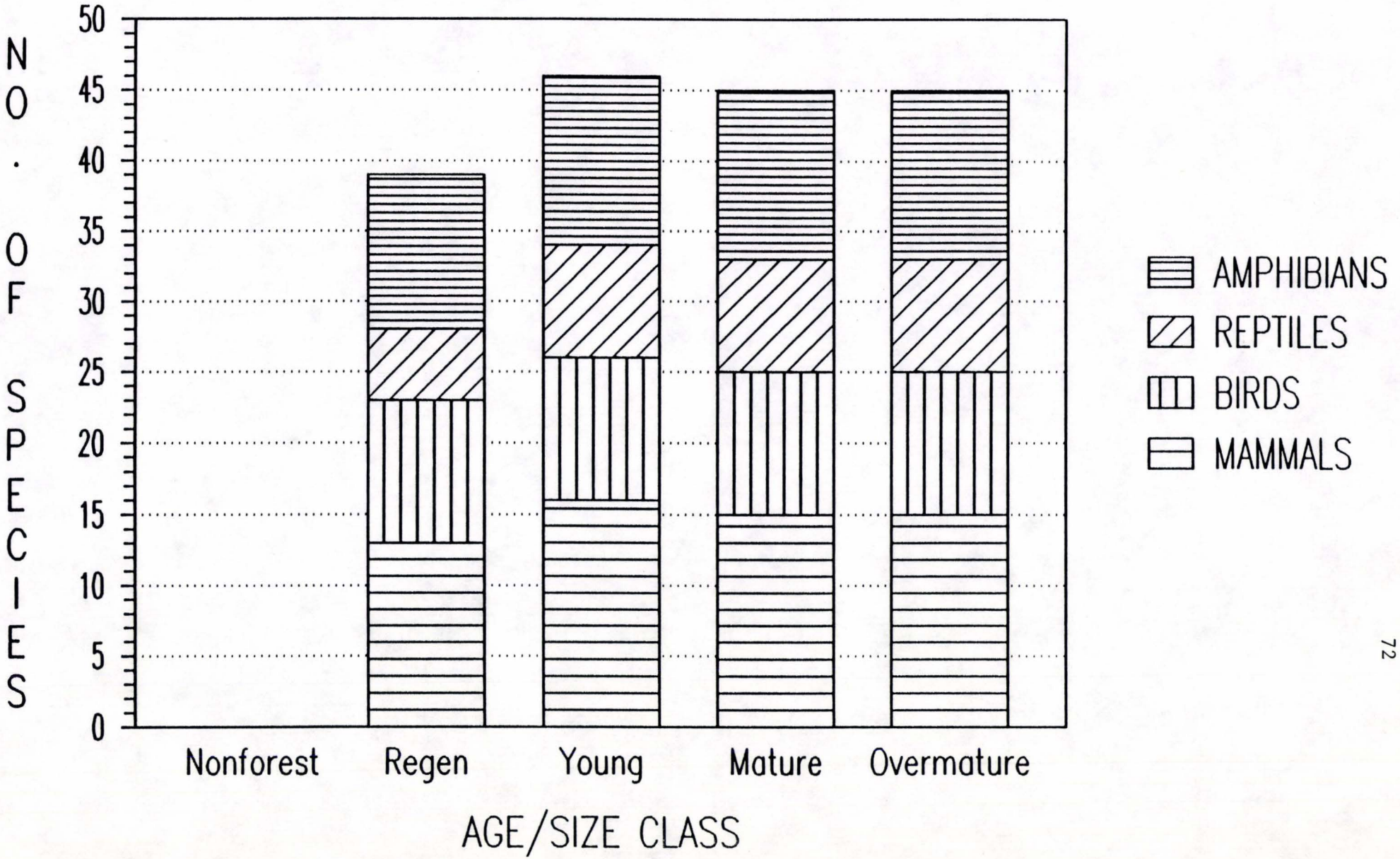
Taxonomic Comparisons by Age/Size Class



Appendix A-12.

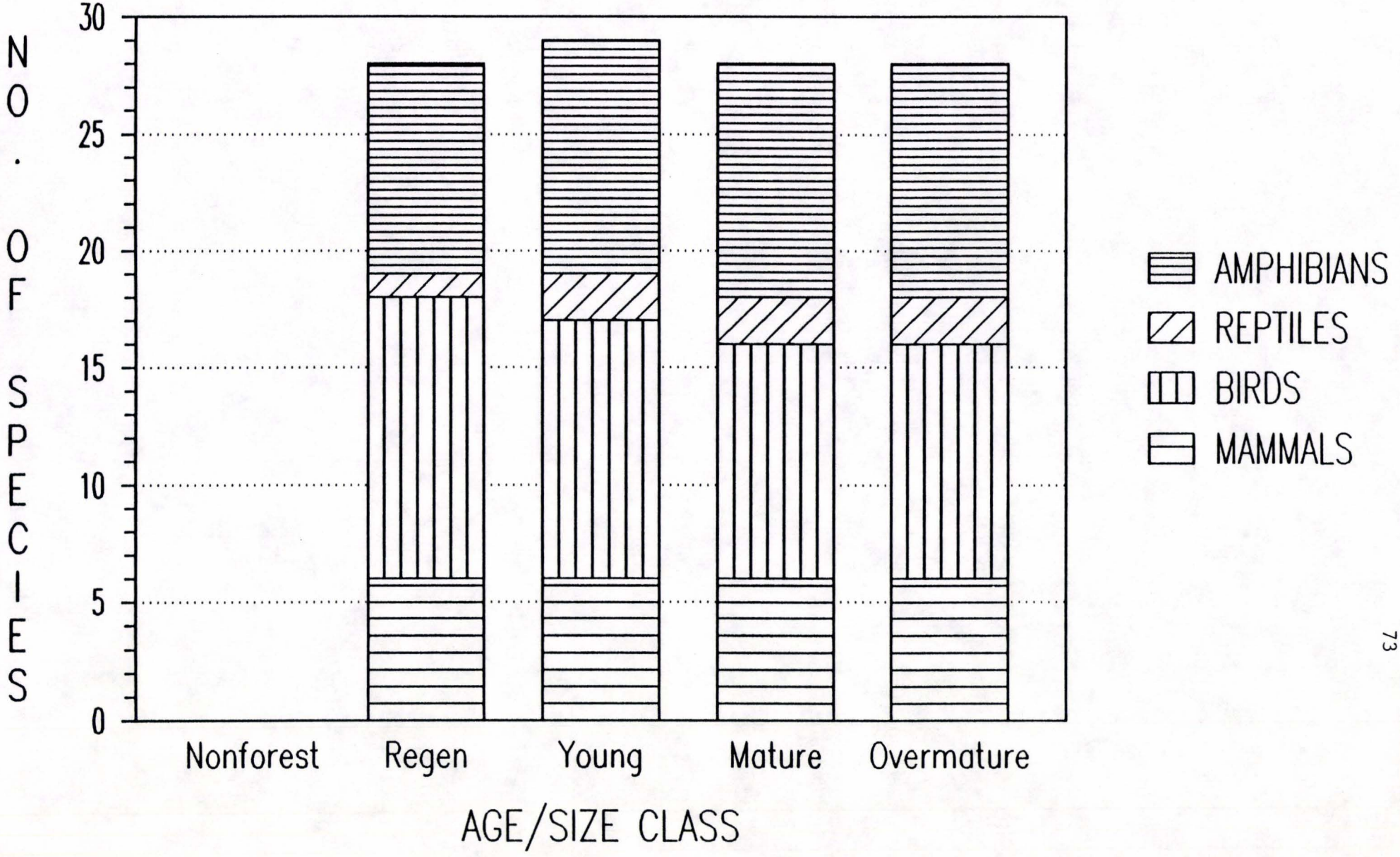
DEAD AND DOWN MATERIAL USE

Taxonomic Comparisons by Age/Size Class



LITTER USE

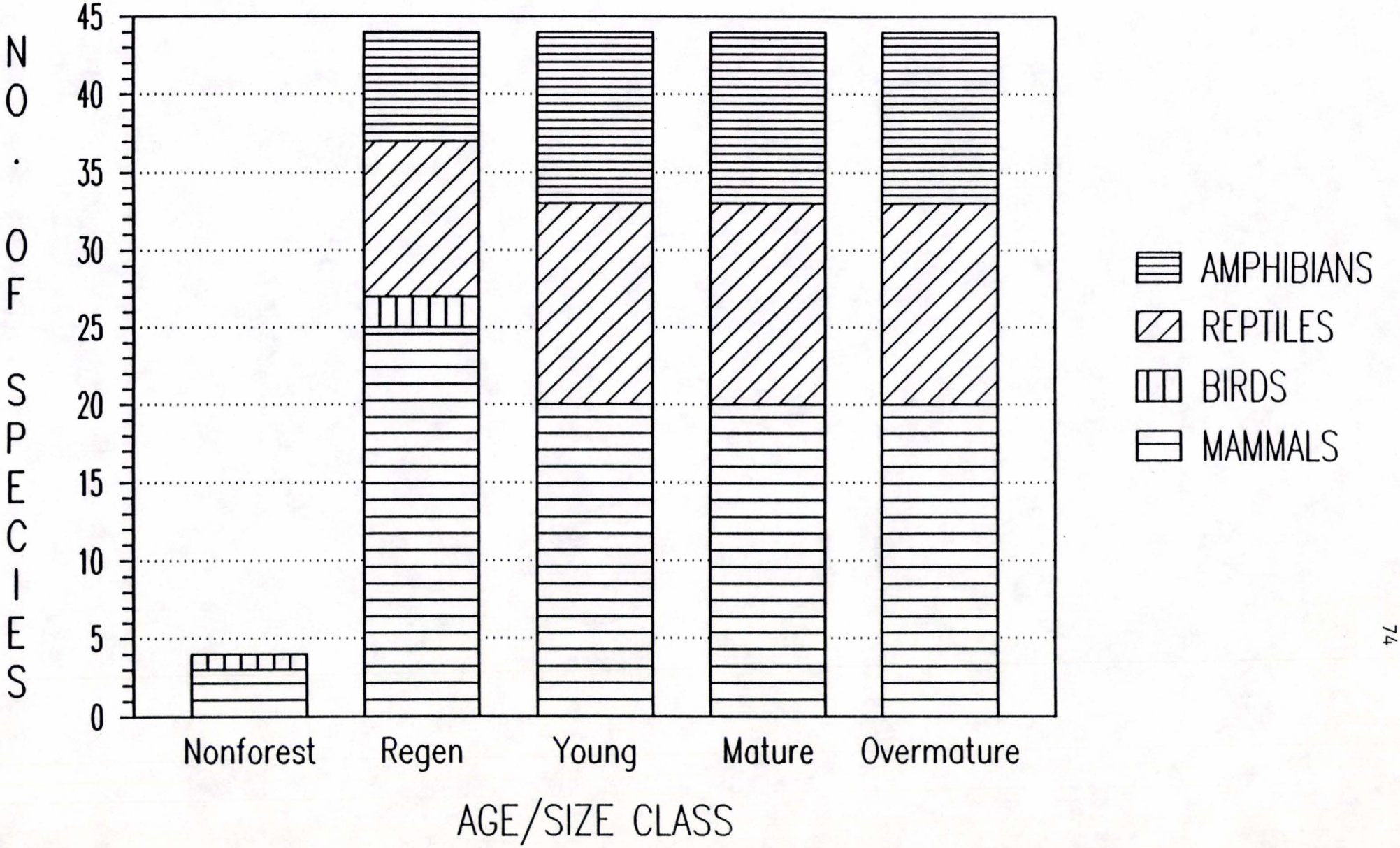
Taxonomic Comparisons by Age/Size Class



Appendix A-14.

SUBTERRANEAN USE

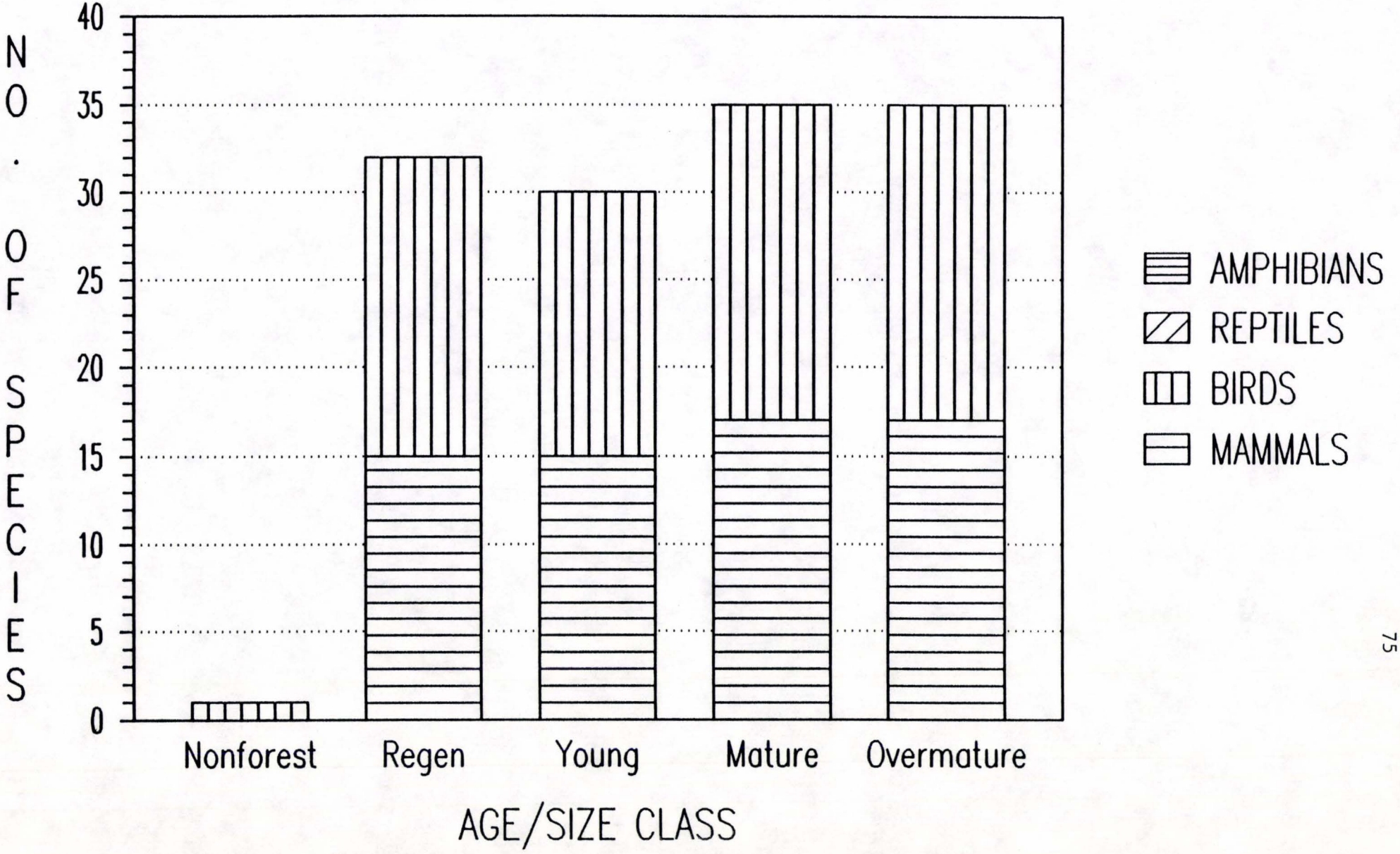
Taxonomic Comparisons by Age/Size Class



Appendix A-15.

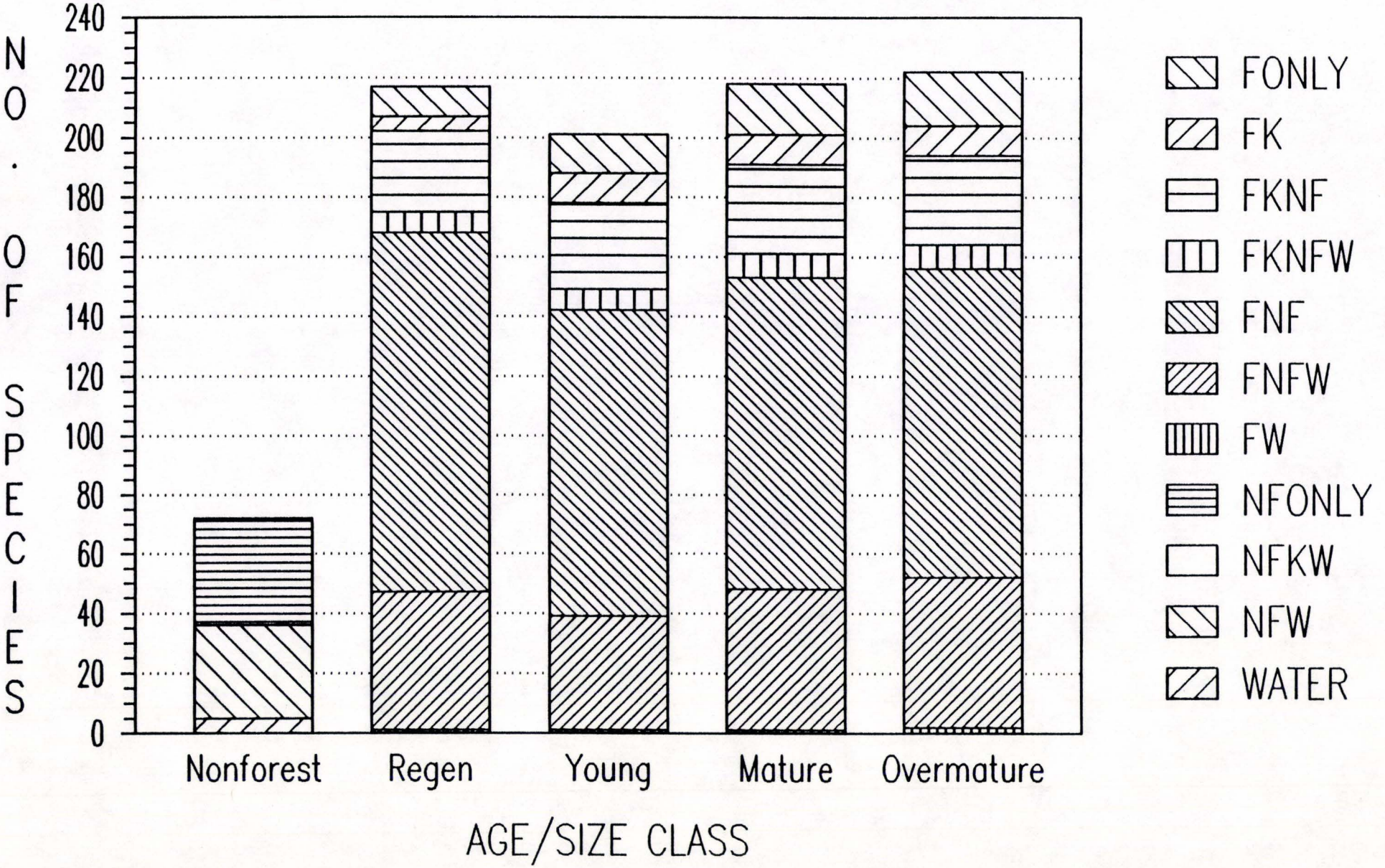
MAST USE

Taxonomic Comparisons by Age/Size Class



HABITAT BREADTH DISTRIBUTION

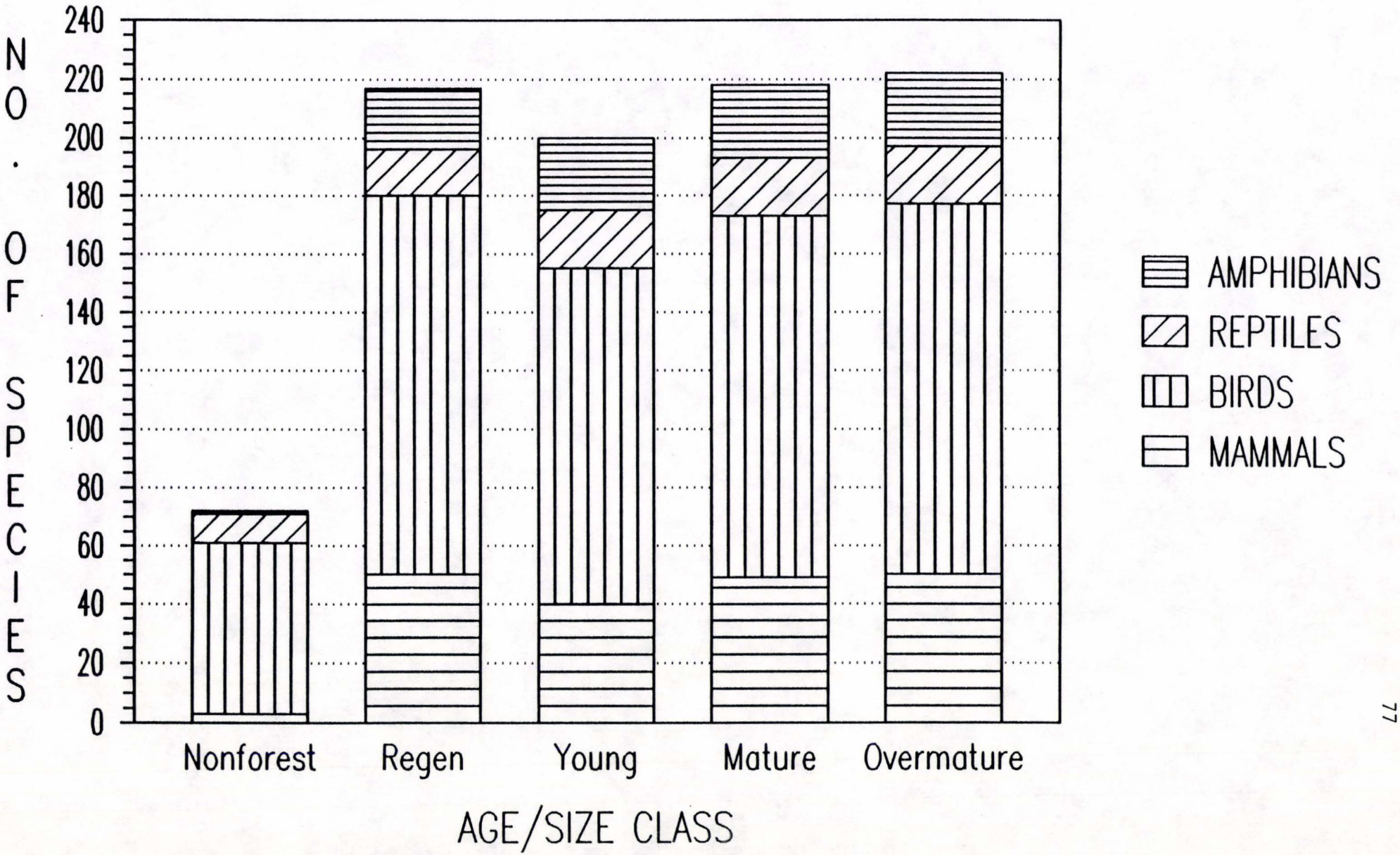
by age/size class



Appendix B-2.

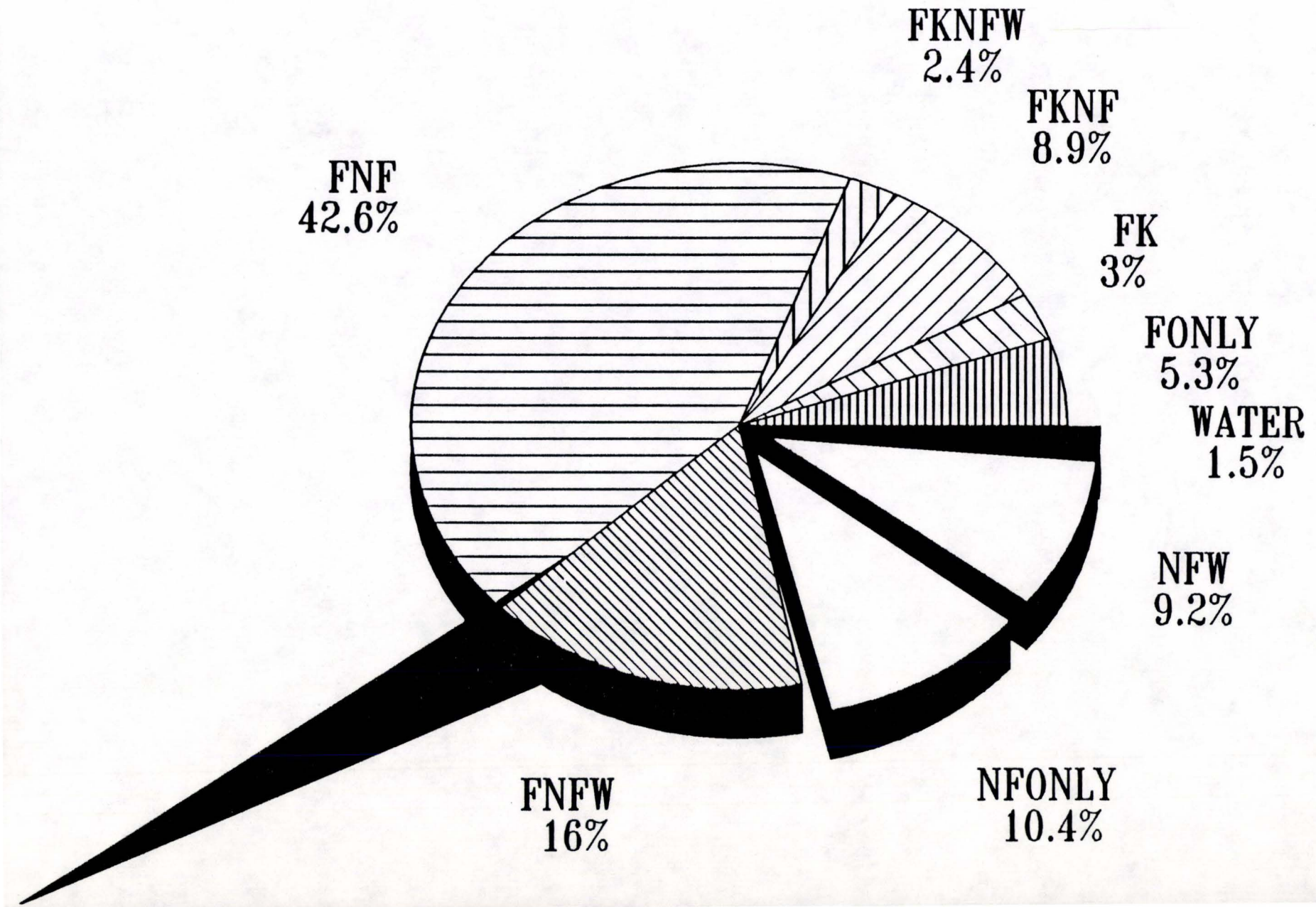
HABITAT BREADTH DISTRIBUTION

Taxonomic Comparisons by Age/Size Class



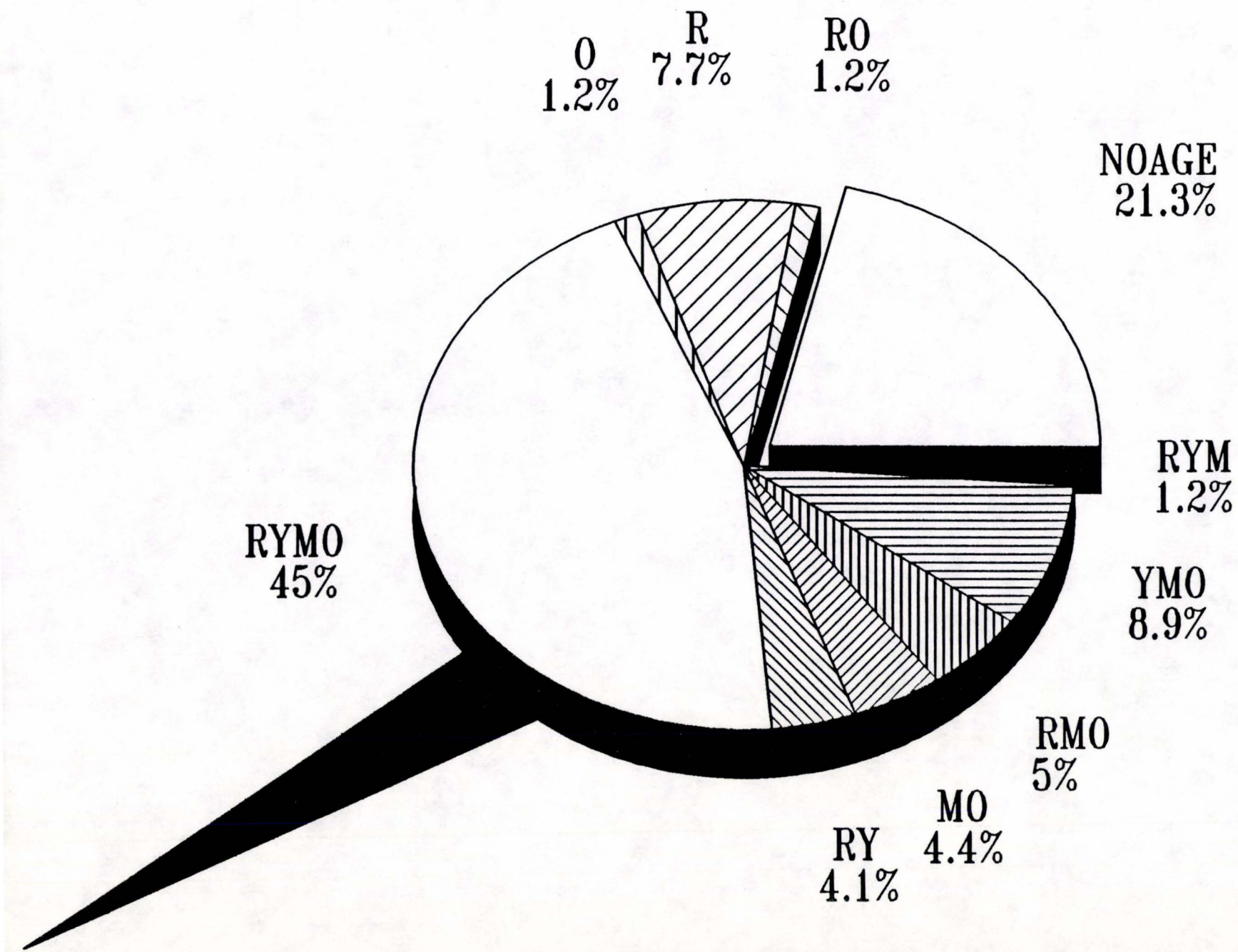
HABITAT BREADTH DISTRIBUTION

For 338 Wildlife Species Found in New England



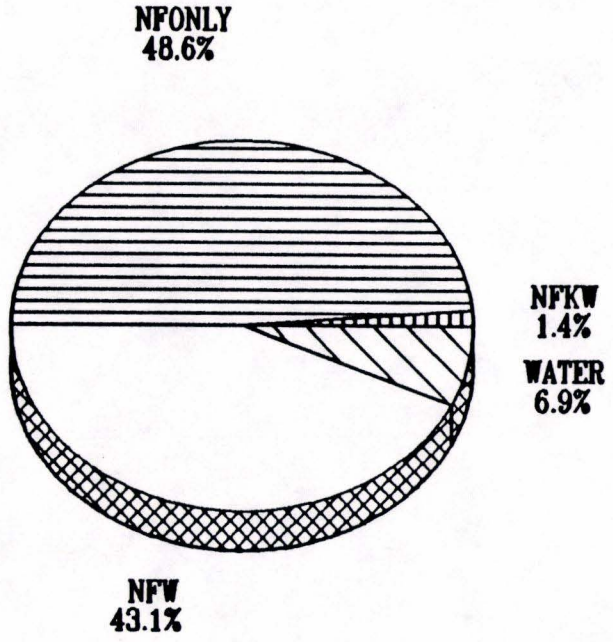
AGE CLASS COMBINATIONS

For 338 Wildlife Species Found in New England

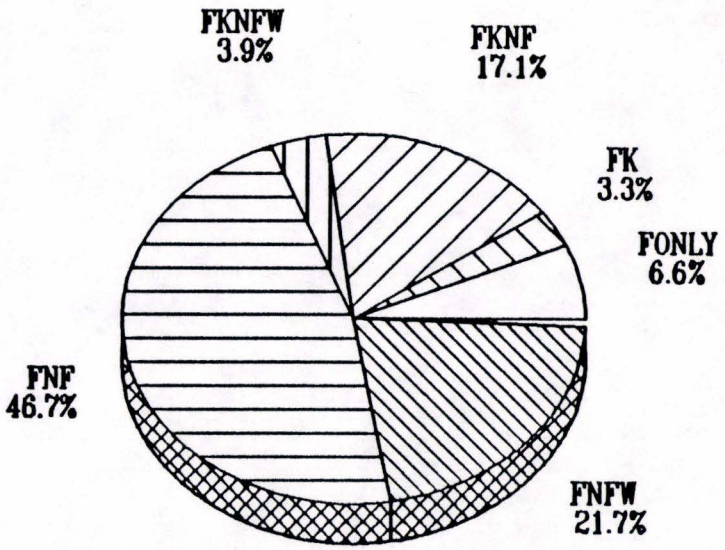


HABITAT BREADTH DISTRIBUTIONS

For Selected Age Class Combinations



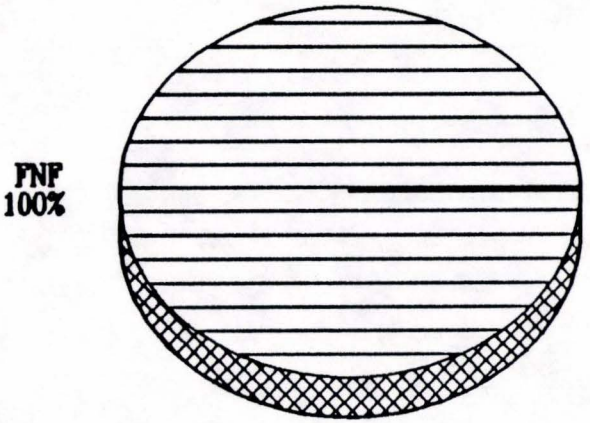
NOAGE (21.3%)



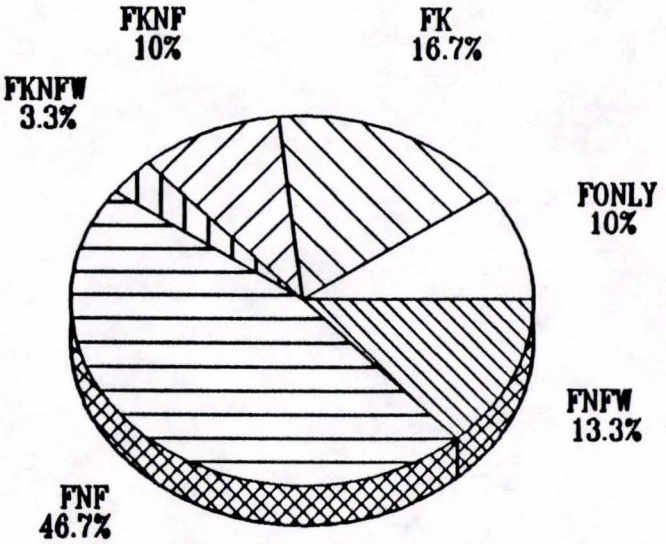
RYMO (45%)

HABITAT BREADTH DISTRIBUTIONS

For Selected Age Class Combinations



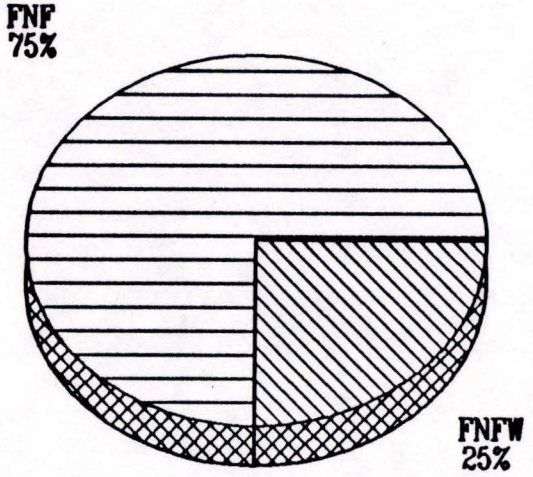
RYM (1.2%)



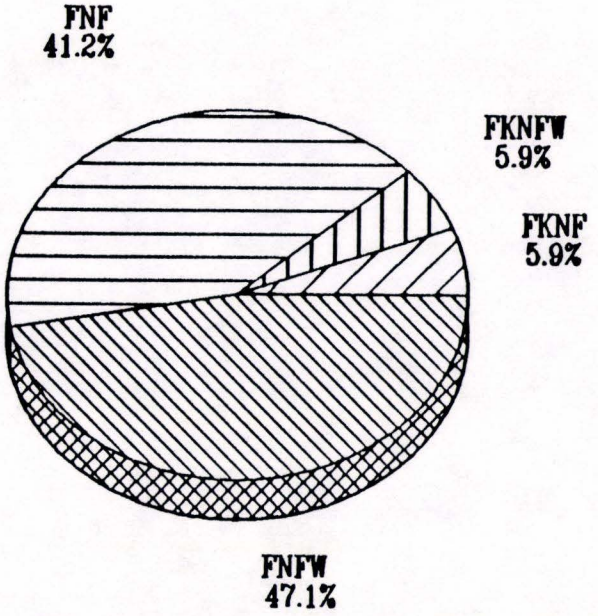
YMO (8.9%)

HABITAT BREADTH DISTRIBUTIONS

For Selected Age Class Combinations



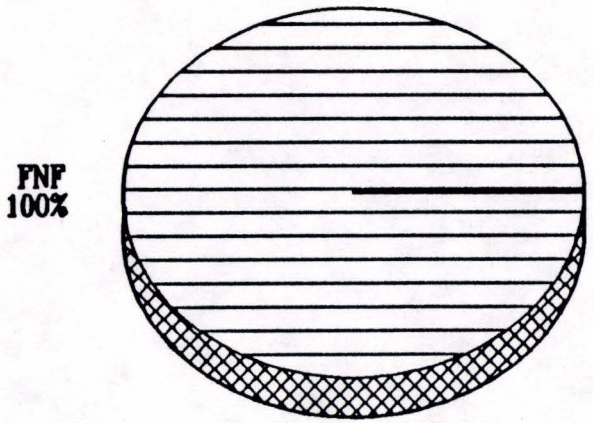
RO (1.2%)



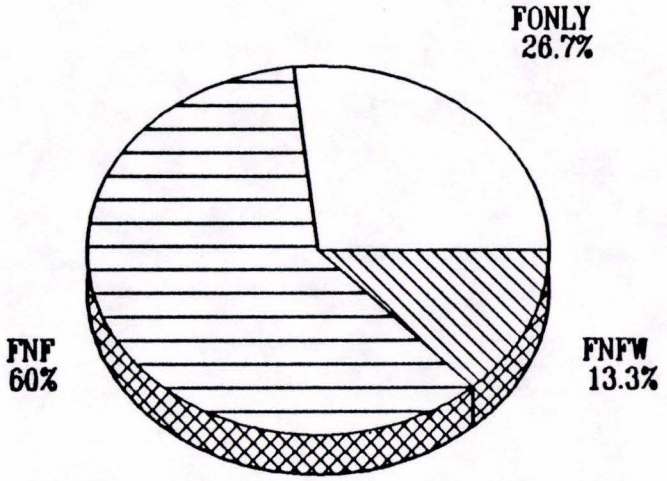
RMO (5%)

HABITAT BREADTH DISTRIBUTIONS

For Selected Age Class Combinations



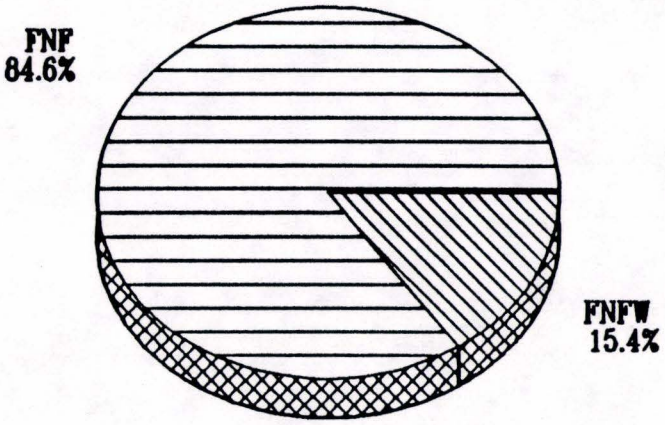
RY (4.1%)



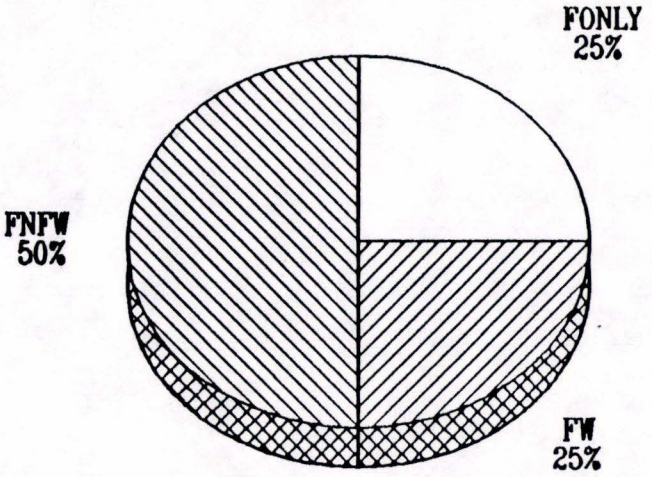
MO (4.4%)

HABITAT BREADTH DISTRIBUTIONS

For Selected Age Class Combinations



RONLY (7.7%)



OONLY (1.2%)